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Canadian Ranger Rifle: Human Factors Requirements Validation

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by:

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Abstract

The Directorate of Land Requirements (DLR) is engaged in an acquisition process that will deliver a new Canadian Ranger Rifle (CRR) capability to the Canadian Forces (CF). The aim of this project was to assist the DLR in assessing the draft operational requirements and better define the overall CF requirement for a new CRR. Eight half-day workshops were held with 135 Canadian Ranger (CR) personnel from four of the five Canadian Ranger Patrol Groups (CRPG). The workshops were broken down into five modules: background information, weapon use inventory, performance requirements, basic technical requirements, and detailed technical requirements. The in-service Lee Enfield No 4 Mark 1* rifle is generally considered a durable, reliable, and accurate weapon but is faulted for its weight, age and availability of parts, and magazine. Protection from predators, hunting/survival tool, and a symbol of Canadian sovereignty/CR were the most important roles of the CRR. Reliability, accuracy, and durability in extreme environments were most important performance criteria. The basic and detailed technical requirements modules collected CR preferences on specific characteristics and features wanted in the new CRR. Results suggest the new CRR should be a bolt action of .308 Winchester / 7.62mm calibre that is shorter and weighs less than the current Lee Enfield. Further technical requirements are presented and discussed. Overall, the results from these workshops indicate that the CR require a reliable, durable, and accurate rifle, with updated features that is lighter than the current Lee Enfield.

Résumé

La Direction – Besoins en Ressources Terrestres (DBRT) est engagée dans un processus d’acquisition qui livrera une capacité de nouveau Fusil de Rangers Canadiens (FRC) aux Forces Canadiennes (FC). Le but de ce projet était d’assister la DBRT dans l’évaluation d’une ébauche de besoins opérationnels et de mieux définir les besoins globaux qu’on les FC envers un nouveau FRC. Huit ateliers d’une demi-journée ont eu lieu avec 135 Rangers Canadiens (RC) provenant de quatre des cinq Groupes de Patrouilles des Rangers Canadiens (GPRC). Les ateliers furent divisés en cinq modules : informations générales, inventaire de l’utilisation d’armes, les critères de performances, les exigences techniques de base et exigences techniques détaillés. Le fusil Lee Enfield No 4 Mark 1* actuellement en service est généralement considéré comme une arme durable, fiable et précise mais est prise en défaut pour son poids, son âge et la disponibilité des pièces et de son chargeur. La protection contre les prédateurs, outil de survie/de chasse et un symbole de la souveraineté/RC étaient les rôles les plus important du FRC. La fiabilité, précision et la durabilité dans des environnements extrêmes furent les critères de performance les plus important. Les modules d’exigences techniques de base et détaillées ont collectés les préférences des RC sur des caractéristiques et fonctions désirées sur un nouveau FRC. Les résultats suggèrent que le nouveau FRC devrait être une Winchester .308 à verrou de calibre 7.62mm plus courte et plus légère que la Lee Enfield actuel. D’autres exigences techniques sont présentés et discutés dans ce document. Dans l’ensemble, les résultats de ces ateliers indiquent que les RC exige un fusil fiable, durable et précis avec des fonctionnalités mises à jour tout en étant plus léger que la Lee Enfield actuel.

Executive Summary

Canadian Ranger Rifle: Human Factors Requirements Validation

Harry Angel, Andrew Morton, Chris Ste-Croix, Brian Mangan, and Paul Vilhena, Humansystems® Incorporated. DRDC Toronto No. CR2010-174; Defence Research and Development Canada – Toronto; August 2010.

The Canadian Rangers (CR) are Canada's military presence in the sparsely settled northern, coastal, and isolated areas of Canada. CR are provided a .303 Lee Enfield No 4 Mark 1* rifle for self defence against large predators and as a hunting tool for personal survival; however, the current issued rifle is difficult to sustain and in need of modernization. The Directorate of Land Requirements (DLR) is engaged in an acquisition process that will deliver a new Canadian Ranger Rifle (CRR) capability to the Canadian Forces (CF). The aim of this project was to assist the DLR in assessing the draft operational requirements and better define the overall CF requirement for a new CRR.

Eight half day workshops were held with 135 CR personnel from four of the five Canadian Ranger Patrol Groups (CRPG). CR personnel sampled varied in experience, gender, patrol communities, CR activities, and rifle use. The sample of CR participants was smaller than requested and did not proportionally represent the CR population. The workshops were broken down into five modules: background information, weapon use inventory, performance requirements, basic technical requirements, and detailed technical requirements. CR participants responded to survey questions and took part in moderated focus group discussions.

The weapon use inventory sought to establish the CR participants' patterns of use of the current issue Lee Enfield. The Lee Enfield is primarily used for formal military taskings typically annually or semi-annually training with a total of 101-200 rounds fired per year. It is not the primary hunting rifle for most CRs but is usually the only weapon carried while on patrol. Range targets are the most commonly engaged targets, with unsupported postures at distances of 50-200m. The Lee Enfield is transported via a variety of vehicles, typically stored in the individual CR's home, and cleaned after each use. Differences were observed in Lee Enfield use profiles between individual CR and the different CRPG. The Lee Enfield is generally considered a durable, reliable, and accurate weapon but is faulted for its weight, age, availability of parts, and magazine. The magazine and iron sights were the most frequently broken components of the Lee Enfield. Participants also described personal weapons which they felt would be suitable replacements for the Lee Enfield. Winchester and Remington rifles that were prized for their accuracy, weight, and durability, in .308 or .30-06 calibre, mounted with a scope, and used to hunt mostly large game at ranges typically between 101 and 200m were most common.

The performance requirements module sought CR input on the role, general performance requirements, engagement distances, and other characteristics of the future CRR. Protection against predators, a hunting/survival tool, and a symbol of Canadian sovereignty/CR were the most important roles of the CRR. Reliability, accuracy, and durability in extreme environments were the most important performance criteria. Conversely the performance requirements with the lowest importance ratings were modularity / configurability / interchangeability, compatibility with other equipment, and ease of training / simplicity. The relative importance of engagement distances followed a normal distribution, with increasing relative importance from ranges less than 50m to peak importance at 100-150m and subsequently decreasing importance to ranges greater than 400m. Participants

indicated that weight, length, and recoil force criteria had follow-on implications and trade-offs, and needed to be balanced such that they would not be too high or too low. While participants placed less importance on a distinctive rifle and rifle aesthetics, the role of the CRR as a symbol of the CR and responses to subsequent questions suggested that a CR branded rifle is desirable.

The basic and detailed technical requirements modules collected CR preferences on specific characteristics and features wanted in the new CRR. Results suggest the new CRR should be a manual repeater, short bolt action, push feed design of .308 Winchester / 7.62mm calibre. The new CRR should be shorter and weigh less than the current Lee Enfield. Right and left hand models as well as multiple stock sizes and adjustable pull lengths should be available. Each CRR should include two 10 round box style detachable magazines which the user is capable of loading five rounds in 5-10 seconds while detached. In addition it must be possible to open the bolt, insert a cartridge into the breech, and prepare the rifle to fire without the use of the magazine. Protected iron sights should be the primary sights, with provision for mounting an optical sight using a NATO standard rail or recreational scope mount. The trigger should be double staged, short stroke, with adjustable pull force and a fixed trigger guard. A two position safety system that is operable with gloves, cocking indicator, and trigger lock are necessary. The new CRR should have a stainless steel barrel and a recoil absorbing system (pads). A sling and hard case are necessary ancillary equipment. Further technical requirements are presented and discussed. Due to time constraints during workshops and expertise of CR participants, a smaller sample was achieved for the detailed technical requirements.

Overall, the results from these workshops indicate that the CR require a reliable, durable, and accurate rifle, with updated features that is lighter than the current Lee Enfield. Limitations and future work are discussed.

Sommaire

Canadian Ranger Rifle: Human Factors Requirements Validation

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Les Rangers Canadiens (RC) sont la présence du Canada dans les zones peu peuplées et isolées du nord et des côtes du Canada. Les RC reçoivent un fusil .303 Lee Enfield No 4 Mark1* pour se défendre contre de gros prédateurs et comme outil de chasse pour leur propre survie; par contre, le fusil présentement émis est difficile à maintenir et a besoin de modernisation. La Direction – Besoin en Ressources Terrestres (DBRT) est engagé dans un processus d’acquisition qui livrera une nouvelle capacité de Fusil des Rangers Canadiens (FRC) aux Forces Canadiennes (FC). L’objectif de ce projet était d’assister DBRT dans l’évaluation d’une ébauche de besoins opérationnels et mieux définir les besoins globaux des FC en terme de nouveau FCR.

Huit ateliers d’une demi-journée eurent lieu avec 135 RC provenant de quatre des cinq Groupes de Patrouilles des Rangers Canadiens (GPRC). Les membres des RC échantillonnés variaient au niveau de l’expérience, du sexe, de la communauté de patrouilles, des activités de RC et de l’utilisation du fusil. L’échantillon de participants des RC était plus petit que demandé et ne représentait pas de façon proportionnelle la population des RC. Les ateliers furent répartis en cinq modules : informations générales, inventaire de l’utilisation d’armes, les exigences de performances, les exigences techniques de base et exigences techniques détaillés. Les participants des RC répondirent aux questions du sondage et participèrent à un groupe de discussion modéré.

L’inventaire de l’utilisation de l’arme a établi des profils d’utilisation de la Lee Enfield actuelle des participants des RC. La Lee Enfield est principalement utilisé pour des affectations militaires formelles généralement un entraînement annuel ou semestriel avec un total de 101-200 cartouches par an. Ce n’est pas le fusil de chasse primaire pour la plupart des RC mais c’est généralement la seule arme portée en patrouille. Les cibles de champ de tir sont les cibles les couramment engagées avec des postures non-supportées à des distances 50-200m. La Lee Enfield est transporté dans une multitude de véhicules, habituellement rangé dans la maison de chacun des RC et nettoyé après chaque utilisation. Des différences furent notées dans les profils d’utilisation entre chacun des RC et les différents GPRC. La Lee Enfield est généralement considérée comme une arme durable, fiable et précise mais est prise en défaut pour son poids, son âge et la disponibilité des pièces et de son chargeur. Le chargeur et les viseurs de fer étaient les composantes les plus fréquemment endommagées sur la Lee Enfield. Les fusils Winchester et Remington qui étaient prisées pour leur précision, leur poids et leur durabilité, dans le calibre .308 ou .30-06, monté d’une lunette de visée et utilisé pour chasser surtout du gros gibier à des distances typiquement entre 101 et 200m étaient les plus répandues.

Le module des critères de performances sollicita l’avis des RC sur le rôle, les critères de performances généraux, les distances d’engagement, et autres caractéristiques du futur FRC. La protection contre les prédateurs, outil de chasse et de survie ainsi qu’un symbole de la souveraineté Canadienne et des RC étaient les rôles les plus importants du FRC. La fiabilité, précision et la durabilité dans des environnements extrêmes furent les critères de performance les plus important. Inversement, les critères de performances avec les cotes d’importance les plus basses étaient la

modularité, la configurabilité, interchangeabilité, la compatibilité avec d'autres équipements et la facilité de la formation / simplicité. L'importance relative des distances d'engagement suivait une distribution normale, avec une augmentation de l'importance relative à partir de distances de moins de 50m et un pic d'importance à 100-150m et subséquemment réduisant l'importance des distances de plus de 400m. Les participants indiquèrent que les critères de poids, de longueur et de force de recul impliquaient des interactions et des compromis qui devaient être équilibrés de façon à ne pas être trop élevés ou trop bas. Bien que les participants accordèrent moins d'importance sur l'esthétique et la distinction du fusil, le rôle du FRC en tant que symbole des RC et leurs réponses subséquentes suggérèrent qu'un fusil marqué RC est désirable.

Les modules des exigences techniques de base et exigences techniques détaillés ont recueilli les préférences des RC sur des caractéristiques et fonctions désirées d'un nouveau FRC. Les résultats suggèrent que le nouveau FRC devrait être à répétition manuelle, action à verrou court, conception d'alimentation par poussé d'une Winchester .308 / calibre 7.62mm. Le nouveau FRC devrait être plus court et plus léger que la Lee Enfield actuelle. Des modèles droitiers et gauchers ainsi que plusieurs formats de crosses et des longueurs de tirés devraient être disponibles. Chaque FRC devrait inclure deux chargeurs dix cartouches détachables de style boîte où l'utilisateur est capable de charger cinq cartouches en 5-10 secondes lorsque détaché. De plus, il doit être possible d'ouvrir le verrou, chamberer une cartouche et préparer l'arme à tirer sans utiliser le chargeur. Des guides de visé de fer protégés devraient être les guides primaires avec les provisions nécessaires pour monter une lunette de visé utilisant une raille standard de l'OTAN ou une fixation pour lunette de visé récréative. La gâchette devrait être à deux stages, tiré courte, avec force de tiré ajustable et un garde de gâchette fixe. Un système de sureté à deux positions opérables avec des gants, un indicateur d'armement et verrouillage de la gâchette sont nécessaires. Le nouveau FRC devrait avoir un canon en acier inoxydable et un système d'absorption du recul (coussins). Une ganse et un étui rigide sont de l'équipement auxiliaire nécessaire. De plus amples exigences techniques sont présentées et discutés. En raison des contraintes de temps pendant les ateliers et l'expertise des RC participants, un plus petit échantillon a été obtenu pour les exigences techniques détaillées.

Dans l'ensemble, les résultats de ces ateliers indiquent que les RC nécessitent un fusil fiable, durable et précis avec des fonctionnalités mises à jour qui est plus léger que la Lee Enfield actuelle. Les limitations et travaux futures sont discutés.

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1. Background

The Canadian Rangers (CR) are Canada's military presence in the sparsely settled northern, coastal, and isolated areas of Canada¹. Rangers are part-time reservists tasked with reporting unusual activities, collecting local data to support military operations, conducting surveillance and sovereignty patrols, and assisting the Canadian Forces (CF). Established in 1947, from the predecessor Pacific Coast Militia Rangers, the CR program is a crucial component of CF operations in remote, isolated, and coastal communities of Canada^{2 3}. CR are comprised of approximately 4111 Inuit, First Nations, Métis, and non-Aboriginals located in 163 patrol communities, organized in five Canadian Ranger Patrol Groups (CRPG) across Canada^{1,4} - see Figure 1. The number of CR is expected to increase to 5,000 by March 2012¹.



Figure 1: Canadian Ranger patrol locations⁵

The mission of the CR is to “provide lightly equipped, self-sufficient, mobile forces in support of the Canadian Forces' sovereignty and domestic operation tasks.”⁶ The National Canadian Ranger Task List is to conduct and provide support to sovereignty operations, conduct and provide assistance to CF domestic operations in Canada, and maintain a CF presence in the local community⁶. The CR are

¹ <http://www.armee.forces.gc.ca/land-terre/cr-rc/index-eng.asp> retrieved 9 February 2010

² <http://www.armee.forces.gc.ca/land-terre/cr-rc/history-histoire-eng.asp> retrieved 9 February 2010

³ <http://www.cbc.ca/news/background/cdnmilitary/rangers.html> retrieved 18 May 2010

⁴ http://en.wikipedia.org/wiki/Canadian_Rangers retrieved 9 February 2010

⁵ http://www.army.forces.gc.ca/land-terre/images/reserve/rangers/map_big.jpg retrieved 10 February 2010

⁶ <http://www.army.forces.gc.ca/4crpg/contents.asp> retrieved 31 May 2010

referenced in the 2005 Defence Policy Statement in the sections on Domestic Operations and Protecting Canada and Canadians⁷. Specifically, CR are cited for their role in supporting Canada's sovereignty. CR contribute to the defence of North America through their patrolling, protect Canadians by assisting in disaster relief, and contribute to nation building through programs such as the Junior Canadian Rangers (JCR)⁶. Other tasks of the CR include providing local expertise, guidance, and advice; conducting Northern Warning System (NWS) patrols; and providing local assistance to Search and Rescue (SAR) activities¹. The CR are an invaluable operational resource for the CF. CR are not intended to conduct tactical military training, immediate local defence, vital point security (dams, mines, oil pipelines, etc), assist police in discovery, reporting and apprehension, or aid to the civil power⁶.

The standard issue of equipment provided to CR includes a red Canadian Ranger sweatshirt, Canadian Disruptive Pattern (CADPAT) pants, combat boots, baseball cap, safety vest, rifle, and navigation aids⁴. CR have access to additional equipment through their patrol group and are paid an equipment usage fee when utilizing their own equipment. The rifle capability is provided as a military small arm or anti-personnel weapon, for self-defence against large predators, and for personal survival⁸. The rifle currently supplied to CR is the .303 Calibre, Lee Enfield No 4 Mark 1*, a bolt action magazine fed repeating rifle – see Figure 2.



Figure 2: Lee Enfield No 4 Mk 1⁹

The first Lee Enfield Mark 1 rifles were issued to the British Army in 1895, while the Lee Enfield No 4 Mark 1 used by CR today began manufacture in 1941¹⁰. Lee Enfield rifles use a rear-locking bolt action system in which the action cocks the striker on the closing stroke of the bolt and features a 10 round, detachable magazine¹⁰. These design factors combined, with the proximally located operating handle, make the Lee Enfield rifle design very fast and easy to operate. The Lee Enfield uses a square-shaped rifling system to accommodate the higher heat and pressure generated by its ammunition, which was state of the art at the time of its development¹⁰. Over the years the Lee Enfield has been refined to simplify manufacturing, sights, bolt action, operation, reliability, and maintenance¹⁰. The Lee Enfield No 4 Mark 1* was removed from active service in the majority of the Canadian Forces in the 1950s being replaced by the 7.62 x 51mm North Atlantic Treaty Organization (NATO) Fabrique Nationale (FN) C1 Rifle; however, CR continued to use the Lee Enfield because of simplified training and reduced costs¹¹.

⁷ Graham, B. (2005) CANADA'S INTERNATIONAL POLICY STATEMENT, A role of Pride and Influence in the World: DEFENCE. ISBN 0-662-68940-2.

⁸ STATEMENT OF OPERATIONAL REQUIREMENT - SMALL ARMS REPLACEMENT PROJECT 2 - CANADIAN RANGER RIFLE CAPABILITY

⁹ OPTIONS ANALYSIS - SARP 2 - CANADIAN RANGER RIFLE

¹⁰ <http://militaryhistory.about.com/od/smallarms/p/leenfield.htm>, and <http://world.guns.ru/rifle/rfl04-e.htm> retrieved 3 May, 2010

¹¹ <http://www.casr.ca/mp-enfield.htm> retrieved 8 June 2010

Canada's stock of the Lee Enfield No 4 Mark 1* rifles is nearly exhausted, being sustained since the 1980s via the international arms market, a source which is now believed to also be exhausted¹¹. The vital parts of the rear sights and magazines are "virtually impossible to obtain in the quantities needed."⁸ Furthermore, while the rifle design and performance is generally considered to meet the operational requirements of the CR, the .303 calibre bullet is noted to be "deficient as an anti-predator and anti-personnel round."¹¹ Finally the age and condition of the rifle are believed to convey a negative message to individual CRs¹¹.

Prime Minister Stephen Harper announced in August 2007 an expansion of CF operations in the Arctic, one aspect of which is the modernization of the CR uniforms and equipment¹². A Statement of Operational Requirement (SOR) has been drafted for the Canadian Ranger Rifle (CRR) capability (see Annex A) and an options analysis conducted - see Annex A^{8, 11}. The draft SOR defines 36 essential and 5 desirable performance characteristics of a future CRR capability. The options analysis considered maintaining the status quo, abandoning the CRR requirement, substituting assault rifles in service with the CF, procuring a Commercial off the Shelf (COTS) rifle, procure a Military off the Shelf (MOTS) rifle, or develop a new CRR for manufacture in Canada. The current project will seek individual CR input on the requirements and options for a future CRR capability.

1.1 Acronyms

The following acronyms are used throughout this report:

CADPAT	Canadian Disruptive Pattern
CF	Canadian Forces
COTS	Commercial off the Shelf
CR	Canadian Rangers
CRPG	Canadian Ranger Patrol Group
CRR	Canadian Ranger Rifle
DLR	Directorate of Land Requirements
FN	Fabrique Nationale
HF	Human Factors
HSI [®]	Humansystems [®] Incorporated
JCR	Junior Canadian Rangers
MOTS	Military off the Shelf
NATO	North Atlantic Treaty Organization
NWS	Northern Warning System
SAR	Search and Rescue
SME	Subject Matter Experts
SOR	Statement of Operational Requirement

¹² <http://www.pm.gc.ca/eng/media.asp?id=1785> retrieved 10 February 2010

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2. Aim

The Directorate of Land Requirements (DLR) is engaged in an acquisition process that will deliver a new CRR capability to the CF. The aim of this project was to assist the DLR in assessing the draft operational requirements and better define the overall CF requirement for a new CRR. Specific attention was paid to the Human Factors (HF) aspects of the CRR requirements. The goals of this project were to conduct a requirements validation exercise with CR personnel, analyze the results, and present results to aid DLR in refining the CRR SOR.

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3. Methods

Eight separate half day workshops with Subject Matter Experts (SME) were used to gather information from the CR to further define operational requirements for a new CRR. The workshops were conducted with CRPG 1, 3, 4, and 5. A total of 135 CR personnel participated in the eight workshops across Canada.

The workshops were broken down into five modules: background information, weapon use inventory, performance requirements, basic technical requirements, and detailed technical requirements (if time permitted). An audience response system was used in all workshops to gather feedback from the SMEs followed by moderated focus group discussions. The methodologies for each of these activities are presented in the following sections.

3.1 Search

A preliminary search was conducted of publicly available databases for literature concerning existing rifle requirements, bolt action rifle lessons learned, rifle sights, and rifle features. A second search of potential features of a future CRR was also conducted. The findings of both searches were used in the development of the requirements validation exercise and used in the development of the protocol. The following databases were used in conducting the searches: Google search engine of the internet, Humansystems[®] Incorporated (HSI[®]) library, commercial product literature, and others as deemed appropriate.

3.2 Workshop Modules

This study employed a combination of paper based surveys, audience response system interaction, and moderated focus group discussion for capturing SME responses. Respondents were asked a series of questions divided into modules in each workshop. The modules included:

- Background Information;
- Weapon Use Inventory;
- Performance Requirements;
- Basic Technical Requirements; and
- Detail Technical Requirements.

At the beginning of each workshop the HF facilitator briefed the participants on the purpose of the workshop, the types of questions they would be required to answer, and the procedures for using the Turning Technologies 'clickers' – see Figure 3. Turning Technologies 'clickers' allowed for rapid collection of data anonymously from a group, with instantaneous summary of responses available for discussion. The participants used the same Turning Technologies 'clicker' for the whole workshop. All data collected was anonymous and non-attributable to any individual participant.



Figure 3: Turning Technologies Turning Point receiver and clicker¹³

3.2.1 Background Information

A paper-based demographics questionnaire was used to collect the following information from CR participants: gender, age, CRPG, CR experience, and training activities completed. The demographics questionnaire was anonymous, with no identifying information collected. Demographic characteristics were used to describe the CR population sample.

3.2.2 Weapons Use Inventory

Following their background information questionnaire SMEs were briefed on the weapon use inventory questionnaire. SMEs then independently answered each question using the Turning Technology ‘clicker’ wireless response system. The weapons use inventory questionnaire collected data on the use of the issued CRR and other personal weapons by the CR participants. Participants were queried using the ‘clickers’ and a paper-based survey on the frequency of use, activities, postures of use, transportation platforms, storage, cleaning, targets, average distances of use, sights used, and durability issues for the issued CRR. Paper based questionnaires were used to collect make, model, calibre, and best and worst features of personal weapons.

3.2.3 Performance Requirements

Following their weapon use inventory questionnaire, SMEs were briefed on performance requirements questionnaire. Descriptions of all of the performance requirements were provided prior to SMEs assigning weightings. SMEs then independently answered each question using a Turning Technology ‘clicker’ wireless response system.

The performance requirements module surveyed the CR participants on the relative importance of a range of functional criteria for a future CRR. Participants were instructed to respond without any particular design or rifle in mind, but rather in the abstract of what performance characteristics are important to them in a CRR. The ‘clickers’ were used to facilitate rapid data collection and summary, with focus group discussions used to elaborate on rationale, resolve any discrepancies, and provide context. This module included importance ratings of CRR role, performance requirements, engagement distances, and general rifle characteristics. Roles of the CRR discussed were protection from predators, a hunting/survival tool, a symbol of the CR/Canadian sovereignty, and a recruiting tool for the CR. The following performance requirements were surveyed:

¹³ <http://www.turningtechnologies.ca/products/response-options-for-participants/response-receivers/rf-receiver-radio-frequency/> and <http://www.turningtechnologies.ca/products/response-options-for-participants/responsecards/responsecard-rf/> Retrieved 13 May, 2010

- accuracy,
- adjustability,
- compatibility,
- durability in extreme environments,
- durability in handling and transport,
- maintenance,
- modularity / configurability / interchangeability,
- rate of fire / speed of engagement / loading,
- reliability,
- training / simplicity,
- transport / mobility, and
- stopping power.

The general rifle characteristics discussed were weight, length, recoil, branding/aesthetics, and camouflage / freedom from glint.

3.2.4 Basic Technical Requirements

The basic technical requirements module surveyed the CR participants on the preferred specifications and features for a future CRR. Participants were instructed to respond with their knowledge of what designs and features would work well in a future CRR. The ‘clickers’ were used to facilitate rapid data collection and summary, with focus group discussion to elaborate on rationale, resolve any discrepancies, and provide context. The specific Basic Technical Requirement questions are detailed in Annex B.

3.2.5 Detailed Technical Requirements

The detailed technical requirements module followed the same format and general topics as the basic technical requirements module but at a finer level of specificity (if time permitted). This module was divided from the basic technical requirements module such that if time with the CR participants was limited, an entire module could be passed over without missing any of the core content of the requirements validation exercise. The ‘clickers’ were used to facilitate rapid data collection and summary, with focus group discussion to elaborate on rationale, resolve any discrepancies, and provide context. The in-depth Technical Requirement questions are detailed in Annex B.

3.3 Workshop Measures

A number of different measures were used to elicit and capture CR participant feedback during the validation exercise.

3.3.1 Importance Ratings

Using a 7-point Likert scale of importance participants indicated their perceptions of the relative importance of the CR rifle design performance requirements. - see Figure 4

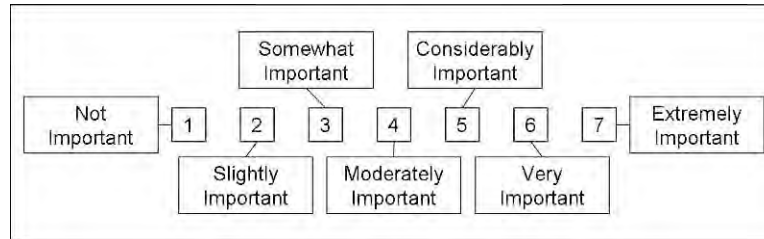


Figure 4: Standard importance rating scale

3.3.2 Forced Choice Alternatives

Throughout the modules, but with particular emphasis in the technical requirements modules, participants provided indications of their preference for specific questions using a predetermined list of alternatives. Where appropriate a “no preference/don’t know” option was also provided for participants who did not know, did not have sufficient experience to judge, or did not have an opinion.

3.3.3 Focus Group Discussion

Focus group discussions were moderated by trained HF experts. The moderators used the module questions as a guide in leading the participants through the different requirements.

3.4 Participants

A total of 135 SMEs (119 males, and 16 females) participated in this study. CR participant ranks were Sergeant (9), Master Corporal (19), Corporal (8), Ranger (94) and unknown (5). While the total sample size was 135, not all CR participants completed all sections of the workshops. As a result some data in this section is incomplete. The mean age of participants was 41.9 years ($n=135$, $SD=12.7$, $max=76$, $min=18$ year), with a mean length of service in the Canadian Rangers of 6.7 years ($n=131$, $SD=8.3$, $max=39$, $min=1$ month). The frequency of patrolling was evenly distributed between annually (26), semi-annually (30), and monthly (28) with a large contingent of the sample not indicating due to being newly formed patrol groups and/or being new CR (51).

Canadian Rangers in this study were also asked to indicate any formal weapons training courses they had taken. The majority (119) of CR had one or more weapon training courses (Ranger Development Phase 1, Firearms Safety Course, Firearms Acquisition Certificate, ranger training exercises).

3.4.1 Locations

There are Canadian Rangers in all provinces and territories except for Nova Scotia, Prince Edward Island and New Brunswick. One hundred and thirty-five CR from CRPG 1, 3, 4, and 5 participated in eight workshops conducted across Canada.

3.4.1.1 1 CRPG

Two workshops were conducted at the headquarters for 1 CRPG (Yellowknife, NWT) with a total of 33 CR representing 27 different patrols. 1 CRPG has a total of 1575 CR spread across 58 patrols in the Yukon, the Northwest Territories, and Nunavut.

3.4.1.2 2 CRPG

No workshops were held with 2 CRPG due to availability of these CR and time constraints on data collection. 2 CRPG has a total of 696 CR in 23 patrols across Quebec.

3.4.1.3 3 CRPG

3 CRPG is located in northern Ontario, with 422 CR in 15 patrols. Four workshops were conducted at 4 different 3 CRPG patrols with a total of 46 CR participants. A large percentage of CR from this CRPG came from recently established patrols and thus had limited exposure to the CRR.

3.4.1.4 4 CRPG

4 CRPG is located on the Pacific west coast and Prairies, with 695 CR in 38 patrols, Alberta, Saskatchewan and British Columbia. One workshop was conducted in 4 CRPG with 27 Canadian Rangers representing 4 different patrols.

3.4.1.5 5 CRPG

5 CRPG is located in Newfoundland and Labrador, with 743 CR in 29 patrols. One workshop was conducted in 5 CRPG with 29 CR representing 11 different patrols.

3.5 Statistical Plan

Descriptive statistics are used in this report to describe the qualitative data collected, including mean, standard deviation, percentage of participants indicating “equal or greater than moderately important” for that particular criterion, and frequency count with percent of participants indicating that choice.

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4. Results

Results are presented in the following sections, mirroring the modules presented to the CR SME participants:

- Weapon Use Inventory;
- Performance Requirements;
- Basic Technical Requirements; and
- Detail Technical Requirements.

A number of participants did not complete all of the data collection sessions due to time limits, lack of experience to answer the question, forgetting to answer the question, and/or difficulty reading / writing. Rather than eliminate the feedback from those CR who did not complete all of the assessments, their data has been included where available. This has resulted in differences in the number of respondents for each area of the modules.

4.1 Weapon Use Inventory

The weapon use inventory module sought to establish the CR patterns of CRR use, as well as any personal weapons. Participants were queried on the current issue Lee Enfield using the ‘clicker’ system and completed paper-based surveys for their personal weapons. See Annex B, Table 11 for detailed results.

4.1.1 Lee Enfield Use Profile

Approximately two thirds (66.4%) of the CR participants indicated that they fired the Lee Enfield annually or semi-annually, while 28.7% indicated monthly, 3.3% indicated weekly, and 1.6% indicated daily. The majority of participants (66.3%) shoot less than 200 rounds with the Lee Enfield per year, with 42.9% of them shooting between 101 and 200 rounds and 23.5% shooting less than 100 rounds; however, there were a number of CR that indicated higher use of the Lee Enfield with 13.3% shooting 201 to 300 rounds, 9.2% shooting 301 to 400 rounds, and 11.2% shooting more than 400 rounds. The annual allotment of ammunition from the CF is 200 rounds per CR. On average, CR participants shot between 101 and 200 rounds per year, where CR from 3 CRPG typically shoot the least (101-200) and CR from 4 CRPG typically shoot the most (201-300). The majority of the participants use the Lee Enfield during military activities (91.9%), while 44.5% use it for hunting and 19.3% indicated it was used for other activities such as shooting competitions. Use of the Lee Enfield for hunting was most prevalent in 1 CRPG (75.8%) and 5 CRPG (70.0%), and least prevalent in 3 CRPG (15.4%) and 4 CRPG (29.6%). The Lee Enfield was not the primary hunting rifle for the participants (70.7%) but was the only rifle carried on patrol by the majority of the participants (71.9%). If another weapon was carried on patrol, the CR indicated that it would be a smaller calibre for small game (e.g. .22) or a shotgun. One workshop group suggested that each patrol community should be allocated a few shotguns for CR to use while patrolling.

4.1.2 Lee Enfield Engagements

The most frequently used shooting posture with the Lee Enfield was prone unsupported (40.2%) followed by prone supported (19.5%), standing unsupported (17.1%), kneeling unsupported (11.0%), standing supported (8.5%), and kneeling supported (3.7%). The vast majority of the participants (97.3%) used an iron sight. The most common target the participants shot with their Lee Enfield were range targets (94.3%) such as bull's eye targets. Large game (31.7%) such as deer, bear, caribou, moose, seals, and whales and small game (25.2%) such as coyotes, wolves, rabbits, pheasants, and ducks were other targets engaged with the Lee Enfield, while other materiel such as rocks, trees, and signs were also engaged by some CR (14.6%). CR from all CRPG targeted large game; however the majority of CR targeting small game were from 1 CRPG and the majority targeting other materiel were from 4 CRPG. The most frequently indicated typical engagement range was 51-100m (50.8%), followed by 101-200m (31.1%). Fewer CR participants indicated typical engagement ranges further out (6.6% at 201-300m, 6.6% at 301-400m, 3.3% at greater than 400m), and very few indicate closer typical engagements (1.6% at less than 50m). CR from 1 CRPG generally indicated further typical engagement distances, centred around 201-300m, while CR from 3 CRPG almost exclusively indicated typical engagements of 51-100m. CR from both 4 and 5 CRPG were generally equally distributed between 51-100m and 101-200m engagement ranges. CR indicated that engagement distance is influenced by both terrain and target. Wooded terrain is often a limiting factor in engagement distances for some patrol areas. Hunting of different animals can also have very different engagement distances; for example moose is often engaged at around 25m while caribou must be engaged at around 400m because of the difficulty in approaching them. Protection from predators is often conducted as far as possible, with shots to kill or scare away.

4.1.3 Lee Enfield Storage, Transport, & Maintenance

The majority of the participants stored their Lee Enfield at home (67.7%); however clear distinctions were observed between patrol groups. CR participants from CRPGs 1, 4, and 5 were permitted to store their Lee Enfield in their homes while CR participants from 3 CRPG either stored their rifles in a patrol base equipment storage container (11.5%) or were members of new patrols that had not been set up with a patrol base for storing equipment and therefore their rifles were still at the 1 CRPG headquarters (20.0%). The Lee Enfield was transported with a variety of modes of transportation, the most common of which were civilian vehicle (65.6%), boat (60%), snowmobile (60%), and ATV (40%). The majority of CR participants cleaned the Lee Enfield after each use (76.4%), with most participants maintaining their rifle either semi-annually (41.2%) or monthly (37.3%). Preventative cleaning measures included bore cleaning (81.7%), other oils and lubricants (60.3%), rust prevention lubricants (59.5%), trigger spray solvent (27.8%), and dry cleaning solvents (16.7%). Seventy-four of the 133 CR participants who completed this section indicated that at least one part of their Lee Enfield had broken - see Table 1 for a breakdown of broken components; however, note that approximately 28 CR had not been issued Lee Enfield rifles yet and as a result frequency counts are used instead of percentages. Magazines and iron sights were the most frequently broken components. Specific magazine problems with the lips and springs, and iron sights loosening were identified as the biggest durability concerns.

Table 1: Frequency of Broken Lee Enfield Components

Lee Enfield Component	Frequency Count (n=74)
Magazine	40
Iron Sight	26
Forestock	14
Sling Swivel	14
Barrel	12
Others	9
Buttstock	8
Receiver/Action	8
Sling	4

CR participants also indicated both the three best and three worst features of the Lee Enfield – see Note that not all participants indicated three features for the best and worst of the Lee Enfield. The most frequently noted best features were its durability (47.0%), reliability (36.5%) and sights (24.3%), and the worst features were its weight (70.8%), age / availability of parts (30.1%), and magazine insertion / release (22.1%).

Table 2: Best and Worst Features of the Lee Enfield

Best Features	Percent (n=115)	Worst Features	Percent (n=113)
Durable, Rugged	47.0%	Weight	70.8%
Reliable, Dependable	36.5%	Age, Availability of Parts	30.1%
Sights	24.3%	Sights (durability, no scope mount)	23.0%
Accuracy	16.5%	Magazine (insertion, release)	22.1%
Magazine (capacity, detachable)	16.5%	Length (too long, sizes not available)	13.3%
Ease of Repair/Cleaning	14.8%	Reliable, Dependable (jamming)	13.3%
Bolt Action, Speed of Cycling	13.9%	Accuracy	10.6%
Calibre, Range	13.0%	Wood Stock (adds to maintenance, 2 pieces)	8.8%
Weight	11.3%	Calibre (too powerful, rimmed cartridge)	8.0%
Ease of Use	10.4%	Bolt Action (pressure needed to load, stiff)	5.3%
Compatibility with Cold Weather	5.2%	Other Features (16)	Less than 5% each
Other Features (9)	Less than 5% each		

4.1.4 Personal Weapons

CR participants filled in paper-based questionnaires regarding their personal weapons. Approximately 70% of the CR participants reported having personal rifles. Of the personal weapons described by the participating CR, 36 were noted as being suitable replacements for the currently issued Lee Enfield. Of these 36 rifles, Winchester and Remington models were suggested as replacement candidates by 8 separate participants (22% of suggested replacement rifles each), 14% were Browning models, and 11%

were Savage models. However, it is noteworthy that of the rifles deemed to not be suitable replacements, 24% were Remington, 23% were Winchester, 9% were Savage, and 5% were Browning. While Winchester and Remington were the most frequently suggested suitable replacements, they were also the most prevalent brands amongst the CR's personal weapons. The most frequent calibres employed among the suitable replacement candidates were .308 (25%), .30-06 (25%), .223 (11%), and .270 (8%).

Concerning those personal rifles suggested as being favourable replacements to the CRR, participants were asked to provide the top three reasons as to why it was a suitable replacement. Among the most prevalent four suggestions (Winchester, Remington, Browning, and Savage), the most common best three features cited were accuracy, lightness of weight, and durability. Other less-common featured deemed to be 'the best' included the iron sights of the Remington rifles, the ease-of-use of the Winchester rifles, and the weight and variety of calibres associated with Remington, Savage and Winchester rifles. By contrast, the worst features of these suggested makes of replacement candidate rifles included, too small of a magazine capacity (ideal was noted as being 10-round capacity), the on-board iron sights, weight (too heavy), and the stock size/shape/material. Furthermore, one CR noted that his personal Remington rifle had frozen while another CR with a different Remington commented that it was prone to jamming up.

Out of the 36 personal rifles reported as being suitable replacements for the current Lee Enfield, 24 were documented as having sights or sighting accessories. Three of these 24 were utilized with only their on-board iron-sights while the remaining 21 were used with some form of optical scope.

The typical targets used by the personal rifles suggested as replacement CRR candidates were large game (72%; moose, elk, bear, deer) and small game (19%; ptarmigan, duck, seal). These targets were most commonly engaged at 101-200 m (49%), 201-300 (20%), 51-100 (14%), and greater than 400m (9%). Shooters tended to use their rifles annually (33%), semi-annually (24%), monthly (21%), or weekly (21%).

In summary, of those personal rifles deemed by the CR participants to be suitable replacements for the current in-service Lee Enfield, the most generally accepted rifle would be manufactured by either Winchester or Remington, be of a .308 or .30-06 calibre, be mounted with a scope, and be used to hunt mostly large game at ranges typically between 101 and 200 m. The most valued aspects of such a rifle would be its accuracy, weight, and durability.

4.2 Performance Requirements

After the participants completed the weapon use module they completed the performance requirements module. Participants were asked to rate the relative importance of CRR role, performance, engagement, and other requirements. Participants used a 7-point scale of relative importance with verbal anchors from not important (1) to extremely important (7) – see Figure 4. For each criterion the mean with standard deviation and percentage of participants rating “moderately important” or better (4-7) are given. Percentages are calculated based on the number of respondents to each individual question. Also, the number of participants (n) included in each criterion is indicated.

4.2.1 CRR Role

In terms of the role of the CRR, participants rated protection against predators, hunting/survival tool, and a symbol of Canadian sovereignty/CR roles between ‘considerably important’ and ‘very

important’ with at least 87% of the participants rating these roles as equal to or greater than ‘moderately important’ – see Table 3.

Table 3: Canadian Ranger Roles Importance Ratings

1 = Not Important; 4 = Moderately Important; 7 = Extremely Important.	n	Mean	Standard Deviation	% Respondents ≥ 4 (Moderately Important)
Protection against predators	132	5.6	1.6	87%
Hunting/survival tool	133	5.5	1.5	89%
Symbol of Canadian sovereignty/ Canadian Rangers	133	5.4	1.5	88%
Recruiting tool	133	4.2	1.9	60%

The protection against predators role would have been rated of even greater importance; if it was not for CR from 5 CRPG feeling this role was between ‘moderately important’ and ‘considerably important’ while CR from the other three CRPG surveyed felt it was ‘very important’. CR are used to provide security against predators for local community events, e.g. over night boy scout outings, etc. The other role suggested for the CRR was as a recruiting tool. Although the mean rating was slightly higher than ‘moderately important’ only 60% of the participants rated it ‘moderately important’ or higher. In focus group discussions, participants indicated that being a CR is not about having a rifle and the new CRR should not be the primary motivation for anyone seeking to become a CR.

It should be noted that this question initially included an erroneous role for the CRR to be a military anti-personnel system. CR are not expected to use their rifles against other personnel and thus this normal military rifle role was removed. CR communities are very sensitive to the CR mission to the point where in some communities bull’s-eye silhouette targets are used vice the typical Figure 11 man-shaped targets used by the CF.

4.2.2 Performance Requirements

Participants were then asked to rate the relative importance of a number of performance requirements for a new CRR. The performance requirements included the following:

- accuracy,
- adjustability,
- compatibility,
- durability in extreme environments,
- durability in handling and transport,
- maintenance,
- modularity / configurability / interchangeability,
- rate of fire / speed of engagement / loading,
- reliability,
- training / simplicity,
- transport / mobility, and
- stopping power.

All of the performance requirements were found to have a mean importance rating of ‘moderately important’ or higher. All but two of the criteria (compatibility and modularity / configurability / interchangeability) were found to be rated as ‘moderately important’ or higher from at least 85% of the participants – see Table 4.

Table 4: Canadian Ranger Rifle Performance Requirements Importance Ratings

1 = Not Important; 4 = Moderately Important; 7 = Extremely Important.	n	Mean	Standard Deviation	% Respondents ≥ 4 (Moderately Important)
Reliability	133	6.2	1.2	95%
Accuracy	132	6.0	1.2	95%
Durability in extreme environments	133	6.0	1.3	96%
Stopping Power	132	5.8	1.4	92%
Durability-handling / transport	133	5.6	1.3	95%
Transport / Mobility	132	5.4	1.3	91%
Rate of Fire / Speed of Engagement / Loading	133	5.3	1.4	92%
Maintenance	133	5.3	1.3	92%
Adjustability	133	5.2	1.3	89%
Training / Simplicity	133	5.1	1.5	86%
Compatibility	132	5.0	1.5	84%
Modularity / Configurability / Interchangeability	133	4.8	1.8	77%

The three performance requirements that had the highest mean importance rating for the future CRR were reliability, accuracy, and durability in extreme environments, which had mean importance ratings of ‘very important’ with some of the lowest standard deviations amongst the performance criteria. Furthermore durability, reliability and accuracy were consistently noted in focus group discussions as being the most important. Stopping power also received consideration in discussions of the most important criteria as CR felt that being able to stop a predator was a safety issue and thereby very important. Conversely the performance requirements with the lowest importance ratings were modularity / configurability / interchangeability, compatibility with other equipment, and ease of training / simplicity. Participants noted that individual CR should not be customizing their CRR as standardization is important. Ease of training / simplicity was discounted in importance as participants felt that any new weapon would be accompanied by a training session and CRs welcome more training; however, in subsequent discussions participants frequently attributed decisions on technical specifications to being the same as the Lee Enfield and what they know.

4.2.3 Engagement Distances

Participants were then asked which engagement distances were the most important for a future CRR. The relative importance of engagement distances followed a normal distribution, with increasing relative importance from distances less than 50m to peak importance at 100-150m and subsequently decreasing importance to distances greater than 400m – see Table 5. Engaging targets at in the three 50m range bands between 50 – 200m were found to have a mean importance rating of ‘considerably important’ with over 80% of the participants rating each of these distances ‘moderately important’ or higher. Targets less than 50m and between 200-300m were rated between ‘moderately important’ and ‘considerably important’. Participants rated engaging targets at distances greater than 300m as of less than ‘moderately important’.

Table 5: Engagement Distance Importance Ratings

1 = Not Important; 4 = Moderately Important; 7 = Extremely Important.	n	Mean	Standard Deviation	% Respondents ≥ 4 (Moderately Important)
Engaging targets at <50m	133	4.6	2.0	68%
Engaging targets at 50-100m	133	5.0	1.5	83%
Engaging targets at 100-150m	132	5.2	1.5	86%
Engaging targets at 150-200m	133	4.9	1.7	80%
Engaging targets at 200-300m	133	4.4	1.9	64%
Engaging targets at 300-400m	133	3.8	2.1	53%
Engaging targets at >400m	133	3.2	2.3	41%

Different CRPGs had different peak importance engagement distances; between 50 and 100m was of the greatest importance for 3 and 4 CRPG; between 100 and 150m was of the greatest importance for 1 and 5 CRPG.

4.2.4 General Rifle Characteristics

Participants were also asked to rate the importance of rifle weight, length, recoil force, distinctiveness/aesthetics (branding), and camouflage/freedom from glint. Weight, length, and recoil force were rated as being ‘considerably important’ with at least 79% of the participants rating it ‘moderately important’ or higher – see Table 6.

Table 6: CRR General Requirements Importance Ratings

1 = Not Important; 4 = Moderately Important; 7 = Extremely Important.	n	Mean	Standard Deviation	% Respondents ≥ 4 (Moderately Important)
Rifle Weight	131	5.0	1.6	84%
Rifle Length	131	4.8	1.5	83%
Recoil Force	131	4.8	1.5	79%
Rifle distinctiveness/aesthetics (branding)	131	4.4	2.0	67%
Camouflage / Freedom from glint	131	4.1	1.9	65%

Participants acknowledged that these criteria (weight, length, recoil force) had follow-on implications and trade-offs, and needed to be balanced such that they would not be too high or too low. For example, a lighter rifle will be easier to carry as CR will walk for long distances; however, a lighter rifle will also generally have higher recoil forces and may be less durable. Length was seen as a trade-off between accuracy (longer) and ease of transport (shorter). Recoil force was given importance as it can be a safety issue, slow engagement times due to the need to reacquire target, and may lead to sore shoulders after long days of shooting; however, recoil counter measures can add weight and complexity to the rifle. Rifle distinctiveness/aesthetics (branding) and camouflage/freedom from glint were found to have importance ratings between ‘moderately important’ and ‘considerably important’ with less than 70% of the participants rating them ‘moderately important’ or higher. While participants placed less importance on a distinctive rifle and rifle aesthetics, the role of the CRR as a symbol of the CR and responses to subsequent questions suggested that a CR branded rifle is desirable. In focus group discussions little utility was found for camouflage and it was seen as a possible negative when attempting to locate a rifle in the bush. Freedom from glint was noted as having importance in some situations (e.g. concealment during observations); however, glint was also noted as a potential means of locating a lost CR. CR from the

four patrol groups surveyed showed good agreement in ratings of weight, length, recoil, and camouflage; however, CR from 4 CRPG placed much less importance on rifle distinctiveness and branding (between ‘slightly important’ and ‘somewhat important’) than CR from the other CRPG (between ‘moderately important’ and ‘considerably important’).

4.3 Basic Technical Requirements

After completing the performance requirements module participants were queried on the basic technical requirements for the future CRR. Participants were presented with a series of questions with specific answer alternatives and were instructed to select the one that they believed would be best suited for the future CRR. Participants were encouraged to indicate ‘Don’t know / No preference’ if they were unsure, did not feel qualified to make such a judgement, or did not have a preferred alternative. The summary of those results are presented in Table 7 with the complete results shown in Annex B, Table 12.

4.3.1 Basic Design

In terms of the basic design of the future CRR, the majority of the participants indicated a manual repeater, bolt action with the push feed design of the Lee Enfield, that uses a .308 Winchester calibre round. A bolt action manual repeater was cited as being more accurate, safer, reliable, easy to clean, fast enough cycling for CR purposes, and what the CR are familiar with compared to semi-automatics. In terms of action design, one quarter of the participants had no preference or were unsure. The push feed design of the Lee Enfield was favoured over the control feed of the Mauser and the hybrid controlled round push feed; however, focus group discussions revealed that many participants were unfamiliar with the hybrid design. The .308 Winchester calibre round was noted as having good stopping power, range, and can be used for big game. Other participants were divided between more powerful calibres (e.g. .30-06) and less powerful calibres (e.g. .223), while 16.5% indicated no preference. Participants also noted that the rifle should be able to fire both commercial and CF rounds (7.62mm) with comments that this will provide another option for ammunition if one source runs out. CR expressed the need for a number of different ammunition options, depending on the purpose of the shooting (e.g. military target shooting, hunting) and indicated that there are lots of options available in the .308 calibre. Participants indicated that right and left handed models of the future CRR are necessary to allow all CR to cycle the weapon with their natural hand. This requirement was endorsed by both left and right handed shooters. Participants noted that as a left handed shooter cycles the bolt of a right handed rifle the cartridge could be ejected into the shooter and cause a burn. A cocking indicator is required as it will make the rifle safer.

4.3.2 Dimensions

As for the general dimensions of the rifle, participants noted that it should weigh less than the Lee Enfield. Participants debated the trade-offs of rifle weight in several of the workshops with some favouring a rifle that is as light as possible, others voicing concerns about recoil forces with light rifles, and some citing a specific ‘ideal’ rifle weight. Survey data shows that participants were spread amongst the options when asked to give a specific upper weight limit, with approximately equal percentages of participants responding 7 lbs, 7.5 lbs, and 8 lbs. Discussions of barrel and total rifle length were similar in that no clear direction was determined. The most common selection for both barrel and total rifle length was no preference / unsure; however, amongst participants indicating specific lengths, a barrel length of 26” with a total rifle not longer than 44.5” long were the most

common selections. These lengths were the longest options given to these two questions. One participant mentioned that the barrel length depends on the terrain but a balance between a long and a short barrel is ideal.

4.3.3 Magazine / Receiver

With respect to the magazine, participants wanted a 10 round detachable magazine. The merits of different capacity magazines were debated during the workshops, with the legal implications of magazines greater than 5 rounds discussed; however, in the end the 10 round magazine was favoured as the extra capacity is appreciated and it is what the CR are used to. Several CR from different workshops indicated that they would be satisfied with a smaller capacity magazine if several magazines (2-3) were provided with each rifle. A detachable magazine was preferred as participants felt detachable magazines are safer. For a loading time requirement, participants were asked how long it should take to load 5 rounds. Discussion in workshop focus groups centred on whether a CR should be able to reload the magazine under duress, with a predator threatening or if speed of magazine reload was more of a convenience requirement. The most prevalent response was that for convenience 5 rounds should be loaded in 5 - 10 seconds, but speed of reload is not a safety requirement. A receiver that allowed for the direct chambering of a round was considered essential to the majority of CR. The direct chambering of a round is important if the magazine jams, the magazine is lost, and for convenience. Storage of extra rounds in the butt stock of the rifle was dismissed by half of the participants, with many participants having no preference (28.8%). Discussion of this feature revealed that while the extra ammunition would be convenient, it would pose a safety hazard with people more likely to accidentally walk off a live range with ammunition, would cause storage issues as rifles cannot be stored with ammunition, and would change the balance of the rifle depending on if the ammunition was present or not.

4.3.4 Stock

Discussion of rifle stock characteristics highlighted personal preferences in rifle design. The most common stock grip and butt stock shape were a semi-pistol grip design with a monte carlo raised butt stock design; however, even this combination would be the first choice of only approximately one quarter of the participants. While a straight grip may be more familiar to participants, the majority chose some variant of a more vertical grip (semi-pistol 47.0%, vertical 3.8%, pistol 13.6%), citing more comfortable and better feeling grips. Participants advocating the monte carlo butt stock argued that it allowed faster acquisition of the sight picture and generally felt more comfortable; however, opponents argued that the fit of a monte carlo butt stock is very personal and a bad fit can make aiming more difficult. A classical style (straight) butt stock was the second most common answer, with advocates noting that it is more familiar, simpler, and more comfortable. Adding an adjustable cheek comb piece was not deemed an appropriate compromise; however, a large percentage of the participants had no preference or were not familiar with adjustable cheek combs (34.1%). A folding butt stock option was put to the CR as a way to achieve both desired total rifle length and ease of transport; however participants commented that a fixed butt stock design is much simpler to use, while a folding butt stock has more moving parts which might make it less durable and is 'too gimmicky'. An adjustable pull length, either through the use of multiple sizes of butt stocks, butt stock add-ons, or some other method, was endorsed by the workshop participants; although nearly one quarter of participants had no preference or were unsure. The ability to adjust the pull length was seen to have benefits in comfort, accuracy, and accommodating different sizes of CR but drawbacks in added complexity of the parts may create durability failure points. A recoil absorbing system, such

as butt stock pads or damper, was favoured by the majority of participants. Participants recalled CR showing up to the range wearing pillows and towels over their shooting shoulders. Given the comfort and safety benefits of reduced recoil, participants concluded an onboard recoil absorbing system would be a good thing. In terms of the materials for the stock, participants wanted a synthetic material (synthetic 32.3%, composite metal/synthetic 17.3%), with wood options (hardwood 25.6%, laminate wood 4.5%) and no preference / unsure (20.3%) being less popular. Reasoning for a synthetic stock included light weight, durability, non-absorbency of water and oils, less maintenance required, and aesthetic appeal; however, proponents of hardwood stated that the Lee Enfield butt stock has withstood the test of time and should be emulated, and in their opinion hardwood was the more handsome option. A camouflage pattern was the most frequent choice for the CRR stock appearance at 27.1% of participants, followed by wood (20.3%) and black synthetic (19.5%). Camouflage was favoured for its “military” appearance and when queried what camouflage pattern they were thinking of, the most frequent response was CADPAT. Participants noted that a camouflaged stock would make the rifle harder to find if lost in the woods and that a single camouflage pattern would not be suitable for all environments and seasons of Canada.

4.3.5 Sights

The inclusion of iron sights on the future CRR was agreed by the vast majority of participants, with most indicating that the iron sight should be the primary sight (iron sights only 18.1%, iron sights with optional optical sights 44.8%). The majority of the participants preferred a protected iron sight with front sight hood guards. Protected sights were favoured as participants mentioned that they are necessary in case of rough handling and unprotected sights are vulnerable to being knocked out of alignment and damage; however, there was no clear indication as to what the iron sight should be or what type of optical sight mount should be included. Participants were split between three iron sight options of peep sight / ghost ring rear sight with square front post (32%), shallow V rear sight with coloured front bead sight (28.0%), and similar to the Lee Enfield combination flip up and peep rear sight (22.0%) with the remainder stating other or no preference. Peep sights were preferred by some participants as they felt that these sights isolate the target well and are very accurate. For an optional optical scope mount, no clear direction was obtained between the options of a NATO standard rail (37.7%) or recreational scope compatible mount (29.8%), while a sizeable percentage indicated no preference / unsure (31.6%).

4.3.6 Miscellaneous & Ancillary Equipment

The ability to take down the CRR to facilitate cleaning and storage was not endorsed by the participants, with the majority preferring a fixed design (56.8%). While the inclusion of a cleaning kit with the CRR was considered essential, there was no clear indication as to whether the cleaning kit should be a separate entity (33.6%), there should be an internal storage compartment for the cleaning kit (23.7%) or some combination thereof (25.2%; no preference 17.6%). A separate cleaning kit was considered advantageous in terms of rifle weight and balance, while an integrated cleaning kit was considered more convenient.

A sling was considered essential ancillary equipment by the majority of participants (85.5%). The option of including a hunting knife with the CRR was favoured by almost half of the participants (48.9%) who stated they would gladly take and use a knife; however, 39.7% of the participants expressed concerns that this would be just another piece of equipment to lose and that the inclusion of the knife would distract or detract from the rifle procurement. The remaining participants had no

preference regarding a hunting knife (11.5%). One workshop focus group discussed the inclusion of a multi-tool instead of a hunting knife, which would have more utility on a range.

In terms of a case, a hard case was preferred to a soft case with only 13.0% advocating for only a soft case; however of the total 79.4% advocating for a hard case, 40.5% felt a soft case was also necessary. Hard cases were argued to be capable of doing anything a soft case can with better durability and protection of the rifle, but were less convenient in some situations (e.g. heavier and bulkier when walking). Participants advised that any hard case provided must be airline approved, lockable, water tight, and should have attachment points for mounting to a vehicle (e.g. snowmobile).

Participants were given three non-exclusive options for means of making the future CRR distinctive; logo/emblem, stock colour, and barrel. Inclusion of a distinctive logo/emblem was the most popular option, but it was not supported by the majority of participants (46.3%). Focus group discussions were generally positive regarding the inclusion of the CR logo on the stock of the CRR. Stock colour (12.7%) and barrel (7.5%) were not popular options for making the rifle distinctive. Other ideas to make the rifle distinctive receiving a minority of CR support included using ranger red on the rifle, a green stock as these were reported to be rare in commercially available rifles, and a stainless steel barrel.

Table 7: CRR Basic Technical Requirements

Criteria	Result
Basic Design	<ul style="list-style-type: none"> • Manual Repeater (66.7%) • Bolt Action (75.9%) • .308 Winchester (49.6%) • Lee Enfield – push feed (46.8%) • Right and left handed bolt action (70.7%) • Include a cocking indicator (82.7%) • Barrel Length – 26" (27%) • Rifle Length – not longer than 44.5" (22%) • Should weigh less than the Lee Enfield (67.2%) • Should not weigh more than 8 lbs. (21.6%)
Magazine/Receiver	<ul style="list-style-type: none"> • 10 round magazine capacity (59.4%) • 5 – 10 second loading time (44.1%) • Detachable (73.2%) • Allows one round to be manually loaded (63.8%) • No extra rounds on the butt (50%) • Should be able to fire both commercial and CF rounds (67.7%)
Stock – Style, Shape, Materials, Finish	<ul style="list-style-type: none"> • Semi-pistol grip (47%) • Monte Carlo (raised) butt stock (48%) • Adjustable pull length (58.6%) • No foldable buttstock (63.9%) • Fixed cheek piece/comb (40.5%) • Include a recoil absorbing system (65.4%) • Synthetic Material (32.3%) • Camouflage (27.1%)
Sights	<ul style="list-style-type: none"> • Iron sight with provision for optical sight (44.8%) • Protected – hood/guards (67.2%) • No clear indication of what iron sight should be • No clear indication of optical sight mount
Miscellaneous/Ancillary Equipment	<ul style="list-style-type: none"> • Should be a fixed design (56.8%) • No clear indication on storage of cleaning kit • Should come with a sling (85.5%) • Should include a hunting knife (48.9%) • Should include both a hard and soft case (40.5%) or just a hard case (38.9%)

4.4 CRR Detailed Technical Requirements

Following completion of the basic technical requirements module, when time with participants permitted and expertise of participants was appropriate, a second more detailed technical requirements module was conducted. The detailed technical requirements was conducted with half of the CR participants from 1 CRPG and all participants from 4 and 5 CRPGs, for a total of 70 respondents although responses to individual questions varied from 19 to 70. Therefore it is important to remember that these results are based on only the sub section of participants. A summary of these results are presented in Table 8, with the complete results shown in Annex B, Table 13.

4.4.1 Action

In terms of the bolt of the CRR, participants preferred it to have a short action, with a 60° locking angle (similar to Lee Enfield or Browning A-bolt). The bolt itself should have a normal ball knob that extends straight out from the receiver at a normal distance, as opposed to the other bolt knob shapes,

angled bolt knobs, and long bolt extensions. Approximately 28% of the participants had no preference as to the type of the knob that the bolt should have.

4.4.2 Trigger & Safety

With respect to the trigger, participants preferred to have a short stroke, double stage trigger (short take up and trigger pull), with an adjustable pull force, and a fixed trigger guard. Participants cautioned that the adjustability of the pull force must be limited to a safe minimum force. Participants were presented with a variety of different safety systems to evaluate and determine which one they would prefer in a future CRR. The majority preferred a simple 2 position safety (safe and ready/fire) that should be located on the top of the rifle. A minority of participants were in favour of a 3 position safety, with the rationale being that a 3 stage allows the bolt to be opened and a round removed without being in a firing position and is thereby safer. A safety located on the top of the rifle was favoured with the reasoning being that with two models of rifle (right and left handed) a top located safety would be universal to both. There was no clear direction as to the style of the safety system (cross bolt, tang style, wing), with the largest percentage of participants unsure or of no preference (38.6%). The overwhelming majority wanted a safety system that is operable with cold weather gloves due to the majority of the operations being performed in cold weather. A storage trigger lock is required. A follow on question regarding a built-in trigger lock was posed to a limited number of CR (n=29) and received a positive response. A built in trigger lock was cited as advantageous in that it is always there, you cannot forget it, cannot lose it, and it is not a weight deterrent.

4.4.3 Ammunition System

With respect to the ammunition systems, participants were overwhelmingly in favour of a box style magazine which is loaded while detached from the rifle. There was a slight preference towards a steel magazine (44.1%) over a polymer magazine (38.2%). Participants from 1 and 4 CRPG generally favoured steel magazines while participants from 5 CRPG typically preferred polymer magazines. Polymer magazines were favoured to steel by some participants as steel magazines can rust, dent, and are cold on the hands; however, the durability of the polymer magazines in the cold was questioned. The majority of the participants preferred to have the CRR come with 2 magazines (i.e. 1 spare); one workshop focus group suggested two different sized magazines, with a 10 round for CR patrols and ranges, and a 5 round for hunting. There was no clear indication of where the magazine release system should be located but there was a slight preference for it to be forward of the trigger (46.6%) as opposed to on the magazine housing itself (36.2%). Proponents of both locations claimed safety advantages in their favoured locations.

4.4.4 Stock & Barrel

Participants were asked to provide feedback on the style, shape, materials, and finish of a stock. With respect to the fore stock shape, participants preferred a hunting style shorter fore stock shape vice a full length fore stock (e.g. Lee Enfield) and with a plain design at the forward most end, as opposed to flared or hand stops, for weight and maintenance reasons. A cross section shape of a standard 2 ½ inch wide oval was preferred. The participants also noted that the stock should come in multiple fixed lengths (for example 12", 13.5", and 15") to accommodate a variety of CR sizes. There are several ways in which the pull length of a rifle could be adjusted. The CR participants preferred to use fixed pads rather than an adjustable butt stock. There was no clear indication as to whether the butt stock

should be fixed vertically or adjustable with shims. Participants did note that the angle of the butt stock should remain fixed. The entire stock should be one piece with grip areas that are either checkered or textured. There was no definitive answer regarding the inclusion of palm swells, with a slightly larger group preferring them (34.8%) to not preferring them (29.0%) but the largest group had no preference or were unsure (36.2%). There are several ways that rifles can reduce the recoil; one is to have recoil pads added to the rear of the butt stock while another way is to have an embedded recoil system in the butt of the rifle. The majority of participants preferred to have recoil pads over no recoil pads, but were not in favour of an embedded recoil system (42.0%) or had no preference (39.1%). The barrel of the future CRR should be stainless steel. Participants were enthusiastic about a stainless steel barrel due to durability advantages and their distinctiveness but noted that stainless steel barrels are not maintenance free. A bipod was not considered desirable, as participants felt it would simply add more weight although one workshop focus group suggested including a small NATO rail on the bottom of the front fore stock for the optional attachment of bipods or night lights. This group also recommended the inclusion of a night light accessory with the future CRR.

4.4.5 Ancillary Equipment

When asked what type of optical sight would be appropriate, the largest percentage of participants indicated the C79 Elcan, which is the currently fielded CF weapon sight (42.0%), while a recreational scope (23.2%) and no preference (18.8%) were other common answers.

The CRR sling should be a two-point sling with padding that has non-slip material on the pad/webbing. Participants noted that a padded sling would be ideal for longer hikes but could make wrapping more difficult. No clear guidance was obtained on the sling material, with the top choices being nylon (34.8%), leather (29.0%), and no preference (24.6%). Leather was noted for its durability but faulted for stretching when wet. Participants commented that durability must be emphasized when choosing the sling material and that sling swivels and buckles must be accordingly robust.

The detailed technical requirements section reaffirmed the need for a lockable gun case. Another case option of a drag bag was discussed in this section and while the largest percentage of participants were in favour (45.2%), many were not familiar with these types of packs and therefore answered unsure / no preference (32.4%).

Table 8: CRR Detailed Technical Requirements

Criteria	Result
Action	<ul style="list-style-type: none"> Short action (65.5%) (i.e. .308 Winchester) 60° bolt locking angle (44.3%) Ball bolt knob (30.9%) Normal bolt knob extension (88.4%) Bolt knob should be straight out from the receiver (51.4%)
Trigger	<ul style="list-style-type: none"> Fixed trigger guard (68.6%) Double stage trigger (68.6%) Adjustable pull force trigger (60%) Short stroke trigger (54.3%)
Safety System	<ul style="list-style-type: none"> 2 position safety (58.6%) Safety system located on top (37.7%) No preference on style of safety system (38.8%) Should be operable with gloves (78.3%) Should include a storage trigger lock (88.4%) Should include a built-in trigger lock (79.3%)
Ammunition System	<ul style="list-style-type: none"> Box-style magazine (88.1%) Steel magazine (44.1%), Polymer magazine (38.2%) Should come with minimum 2 magazines (60.9%) Should be able to load while magazine is detached (82.6%) Magazine release system – forward of the trigger (46.4%), on the magazine housing (36.2%)
Stock & Barrel	<ul style="list-style-type: none"> Hunting style fore stock shape (72.5%) Should have multiple fixed lengths (66.2%), with three sizes – 12", 13.5", 15" (56.1%) Fixed pads adjustable pull length (49.3%) No clear direction for changing the angle of the butt stock (fixed position (45.6%) Should include recoil pads (81.2%) No embedded recoil system (42%), no preference (39.1%) One piece stock (63.8%) Plain fore stock (42%) No preference for or against palm swells (36.2%) Standard 2½" wide oval fore stock cross section (34.8%) Stock grip pattern: checkering pattern (29%), textured (23.2%), no preference (23.2%) Stainless steel barrel (76.8%) No bipod (59.4%)
Ancillary Equipment	<ul style="list-style-type: none"> C79 Elcan sight (42%) Two point sling (75.4%) Padded sling (55.1%) Should include non-slip material on the sling pad (66.7%) Sling should be nylon (34.8%), leather (29%), no preference (24.6%) Lockable gun case (89.9%) Should come with a drag bag/pack (45.6%)

4.4.6 Cleaning Kit

Participants were presented with a list of potential items for inclusion in a cleaning kit and were instructed to select all of the items that they would like to be included – see Table 9. Pull throughs and flexible push rods were the most common items that participants were in favour of having. There were three items that less than half of the participants felt belonged in the cleaning kit (steel push rods, brass push rods, and obstruction remover).

Table 9: Cleaning Kit Contents

Item	Count	% Respondents
Pull Through	47	70.1%
Flexible Push Rods (memory)	41	61.2%
Bore Brush(es)	40	59.7%
Rod Handle (T)	37	55.2%
Gun Oil	37	55.2%
Breech Brush	36	53.7%
Brass Slotted Tips	35	52.2%
Steel Push Rods	32	47.8%
Obstruction Remover	29	43.3%
Brass Push Rods	28	41.8%

5. Discussion and Conclusion

The cumulative results of eight workshops with 135 CR representing 46 patrols from four of the five CRPGs provided insight to the requirements for the future CRR. Application of the current human factors requirements validation data to the draft SOR can be found in Annex C.

In developing the requirements for a future CRR, it is important to keep in mind the role of the CR and the CRR, and their use patterns of the CRR. The CR are a military unit with the CRR as the issued weapon and as such international conventions on military firearms may apply; granted the role of the CR is in sovereignty and domestic operation support with the explicit exclusion of tactical military training, immediate local defence, vital point security, assistance to police, and aid to the civil power. It should be noted that northern communities are very sensitive to the stated roles of the CR, the SOR for a future CRR must therefore be consistent with its intended use if it is circulated for CR comment, e.g. the draft SOR states that the “CR Rifle must be capable of achieving a probability of a hit (P Hit) when fired in a prone supported position of 0.9 against a standing STANAG 4512 [1] unprotected human target at 300 m from the first round” -the target type specified in this requirement statement maybe unacceptable to some Northern community leaders.

The workshops illustrated the diversity present within the CR organization and operating environments. The sample of CR surveyed during these workshops was varied in gender, rank, age, years as a CR, patrol, and culture. Furthermore the operating environments of the CR varied from the arctic, to the coastal mountains, to inland wilderness. These differences illustrated themselves in the CRR use patterns and resultant priorities.

The performance of the current issue Lee Enfield was not surveyed due to time limitations but from focus group discussion, and as implied from other workshop module results, the Lee Enfield appears to be well suited to the needs of the CR with many highly admirable qualities. Furthermore, in justifying their opinions CR participants frequently cited what they are familiar with and what they know works. While this was somewhat contradictory to the lower emphasis placed on the importance of minimizing training and maximizing transfer of training, it was a recurring theme throughout the workshop results.

The following sections mirror the workshop modules reported in the results section.

5.1 Weapon Use Inventory

The use profile of the Lee Enfield demonstrates the diversity within the CR in frequency of use, rounds fired per year, purposes, engagement distances, game, posture, modes of transport, and storage location. Given that the requirement for a single CRR is being developed, the future CRR must be adaptable to many different use profiles and be a general purpose rifle, not specialized for any of the unique circumstances. That being considered, there are a number of loose guidance principles that can be drawn from the CR use of the Lee Enfield. A common commercial calibre is desirable to allow individual CR to supplement their annual allotment of ammunition. A rifle suitable for both patrolling where protection from predators is the primary concern and hunting primarily big game is necessary. The principal engagement range is 50-200m, yet it must be capable of engaging targets beyond 400m. Nearly all types of big game found in Canada may be engaged with this rifle and it will be used on some small game and varmints as well. It will be used in all types of firing postures. The rifle must be extremely durable, standing up to the challenges of extreme cold, wet weather, salt

spray, dirt and mud, rough handling, and infrequent maintenance. It must be easily transportable in a wide range of different vehicles, suggesting that the case(s) must be widely adaptable. Storage of the rifle will also be different across CRPGs, such that while some patrols will ensure storage in a locked gun safe, others will be stored in the CR's home where provision must be made for them to be stored safely and securely.

From the weapons use inventory, the prevalence of hunting amongst the CR participants can also be drawn. While approximately 70% of the CR participants reported owning personal rifles in addition to the issued Lee Enfield, one quarter of participants did not report owning a personal rifle and did not indicate using the Lee Enfield for hunting, suggesting that they did not participate in any rifle based hunting. Furthermore, the data from one fifth of the participants suggested that the annual or semi-annual use of the CRR is their only use of a rifle for the year. This has implications for the simplicity and ease of use required in the new CRR.

The Lee Enfield was praised for its durability, reliability, and sights, suggesting areas for the future CRR to learn from the success of the Lee Enfield over the test of time. The Lee Enfield was faulted for its weight, age / availability of parts, and magazine insertion / release, with the most frequently noted broken components being the magazine and iron sight. These faults can primarily be attributed to age of the design and its associated technology, age of the issued weapons, and lack of a reliable supply of replacement parts and new rifles. While a new line of supply could be developed, this will not counter the age of the design and its associated technology; however, it is important to learn from the success of this long serving rifle. The faults of the Lee Enfield suggest areas to target and improve on for the future CCR.

From the survey of personal rifles listed as suitable replacements for the Lee Enfield, an image of what the future CRR might look like was obtained. This rifle is of .308 or 30-06 calibre, includes an optical scope, is used for large game at ranges of 101-200m, with an annual frequency of use, and is prized for its accuracy, weight, and durability.

5.2 Performance Requirements

The next module established the relative importance of the CRR roles, performance dimensions, engagement distances, and other characteristics. The CRR is primarily a personal protection weapon from the large predators of Canada. While protection from different predators suggest differing requirements, at a minimum this role would dictate a calibre of sufficient power to stop the largest predator, engagement distances that may be closer than desirable, the need to get multiple shots off in an expedient manner, and a reliable weapon not prone to jamming at inopportune times regardless of other factors (environmental conditions, time since last cleaning, etc.). Secondly, the CRR is a hunting tool allowing the CR to live off the land. The areas in which CR operate across Canada are very diverse and as such a calibre appropriate for many different types of game is necessary, with the ability to accurately engage targets further than what may be necessary for personal protection. Finally, the CRR is a symbol of the CR organization and as such is a symbol of Canadian sovereignty. This role is evident with the current issue Lee Enfield as it is a part of the CR logo, crossed with an axe - see Figure 5. The Lee Enfield is a proud symbol of the CR having proven itself as a durable, reliable, and accurate weapon. This role suggests the need for an aesthetically pleasing, distinctive rifle that is standardized across all CR, and performs well enough to be a proud symbol of the CR.



Figure 5: Canadian Rangers Logo

The importance ratings of performance criteria highlight the requirement priorities for the future CRR. While CR were unwilling to compromise any of the performance criteria in a future CRR indicating that none of the requirements were less than moderately important; reliability, accuracy, and durability, with additional consideration of stopping power, emerged as the most important. These closely follow the criteria for which the Lee Enfield received the most praise, which were durability, reliability, and sights with accuracy following as the fourth criteria and also being component of the sights. The need for reliability, and stopping power, is evident in the primary role of the CRR in protecting from predators; however, meeting this reliability requirement is made much more challenging by the extreme environments in which the CR operate and potentially by the infrequency with which it may be used. Accuracy is a necessity in supporting the roles of the CRR as a protection and hunting rifle, but is also necessary if the CRR is to be a proud symbol of the CR. The distances at which the CRR must be considered accurate varied across CRPGs; however, the range of 50-200m was consistently identified as the engagement distance to focus on. The future CRR must be designed, manufactured, and equipped in such a way to allow accurate engagements within this range and much further beyond when employed by a skilled CR. Durability in extreme environments was the third most important performance criteria. CR operate in some of the most extreme environments in the world and demand equipment that can withstand the stresses of these environments. The success of the Lee Enfield as a CRR must be partially attributed to its durability. The future CRR must be extremely durable to be acceptable to the CR and become a symbol of the CR. The least important performance criteria to the CR participants were modularity / configurability / interchangeability. This follows the importance given to the CRR as a symbol of the CR in that the CRR should be standardized and present a consistent image.

The CR participants were willing to acknowledge that many of the rifle characteristics will be trade-offs that must be balanced between competing requirements. The current issue Lee Enfield is considered a long and heavy weapon. In transitioning to a new CRR, participants expect a shorter lighter weapon but are cautious of the impact on recoil forces, accuracy, durability, and other factors. Weight is a disadvantage of the Lee Enfield to the majority of participants, and as such the new CRR must seek to reduce weight while minimizing any negative knock-on effects. The aesthetics and distinctiveness of the rifle were also considered in this section. Importance was given to these characteristics in fulfilling the role of the CRR as a symbol of the CR organization, while differences were observed in the culture between CRPGs.

5.3 Technical Requirements

The technical requirements of the future CRR were broken into basic and detailed requirements. Every participant was able to complete the basic technical requirements module but due to time availability and expertise of available CR only 70 participants were able to complete some portion of the detailed requirements module. Therefore, the results presented on the detailed requirements are not collected from all participants. Both the basic and detailed requirements are summarized in Table 10. The items listed in the table are the results that had the most support from the CR.

The basic requirements that were favoured by the CR are fairly similar to the design of the Lee Enfield (e.g. bolt action, 10 round detachable magazine), with a few exceptions (e.g. semi-pistol grip, .308 Winchester calibre) and a few additions that are the result of modern advances in rifle making over the last few decades (e.g. adjustable pull length, recoil absorbing system).

A bolt action manual repeater rifle was favoured for a number of reasons, including durability, reliability, simplicity, familiarity, and the proven experience of the Lee Enfield. Right and left handed models were requested to accommodate different handedness within the CR population. The .308 Winchester calibre most frequently selected by CR participants has a number of advantages. The .308 Winchester is a commonly available commercial round which is compatible with the CF 7.62mm round, allowing individual CR to supplement their ammunition allotment and making use of the CF standard ammunition possible. This calibre should be capable of providing the stopping power desired, is suitable for big game hunting in Canada, and appears to be a balance between more and less powerful calibres given the task of the CRR.

The majority of the technical requirements that were favoured by the CR are readily available and prevalent in many commercial rifles (e.g. bolt action, locking angle, trigger guard, trigger). One area that may be of concern is finding a rifle that is able to come with the 3 stock lengths that the CR favour (12", 13.5", and 15"), and includes recoil pad(s).

CR workshop participants had a number of suggestions for CRR accessories, including a night light to mount on a NATO standard rail, a multi-tool (instead of a hunting knife), and making the lockable hard case vehicle mountable and water proof.

Table 10: Summary of CRR Basic and Detailed Technical Requirements

Basic	Detailed
<ul style="list-style-type: none"> • Bolt action • Manual repeater • Push feed • Right and left-handed models • Cocking indicator • .308 Winchester calibre • Compatible with both commercial and CF rounds • 10 round, detachable magazine • Load 5 rounds in 5 – 10 seconds • Ability to manually load one cartridge directly into chamber • Monte Carlo or classical style butt stock • Semi-pistol grip • Adjustable pull length (fixed pads) • Fixed (not foldable) butt stock and fixed cheek piece • Recoil absorbing system • Protected iron sights (peep sight possibly with flip sight) and provision for optical sight • Optical sight mount that is compatible with both recreational scope mounts and NATO standard rail • Should come with a sling • Not be able to be taken down (fixed) • A hard case and soft case or just a hard case • Distinctive logo or emblem • Weigh less than the Lee Enfield 	<ul style="list-style-type: none"> • Short bolt action • 60° bolt locking angle • Ball bolt knob • Normal bolt knob length • Fixed trigger guard • Short stroke, double stage trigger with adjustable pull force • Two position safety located on top that is operable with gloves • Should come with a storage trigger lock, possibly built-in • Box style magazine made of steel or polymer • Should come with 2 magazines (1 spare) • Multiple fixed lengths (3 sizes) • Pads as recoil absorbing system (not an embedded recoil system) • One piece stock • Plain, hunting style fore stock shape • Checkered or textured stock grip • Stainless steel barrel • Lockable gun case • Two-point padded sling made from either leather or nylon with non-slip material on the pad • Cleaning kit

5.4 Limitations

There are a number of important limitations to this requirements validation exercise. The majority of these limitations concern the CR participants. In project planning, workshop data from 15% of patrol communities (25 of 163) and 5% of CR (205 of 4111) proportionally distributed across all five CRPGs were estimated as necessary to achieve a representative sample. Due to the constraint that all data collection be conducted during fiscal year 2009/2010, 2 CRPG was not able to provide CR to participate. 2 CRPG is the third largest patrol group covering all of the province of Quebec. This group of CR are not represented in this study. The patrol communities were requested to represent the full spectrum of operating environments, including terrains, climates, and cultures, of the CR across Canada. While representation of 28% (46) patrol communities was achieved which far exceeded the estimated requirement, it is not known if the full spectrum of operating environments were represented. For example, while twice the number of patrol communities from 3 CRPG were represented than requested (4 vice 2), all of the represented communities were from the centre of the province with similar terrain and environments. Finally where 5% of the total CR population were requested for participation, total sample achieved represented only 3%. A large contributing factor to this shortfall in participants was the absence of 2 CRPG; however, 1, 4, and 5 CRPGs were under represented while 3 CRPG was over represented. Therefore while the sample was smaller than requested, it was also not proportionally representative.

The CR participant sample also posed other limitations. Nearly one half of the sample (45.9%) indicated one year or less experience as a CR. Some participants were also constrained by literacy difficulties and cultural differences that limited the sharing of opinions and preferences. The limited expertise of some CR participants with weapons was one of the reasons the detailed technical requirements module was not conducted with all participants. Time constraints with each CR workshop group also limited the conduct of the detailed technical requirements module and other workshop modules.

Originally, two additional modules were planned and developed (familiarity range/static display of sample weapons and Lee Enfield performance evaluation). The intent of these hands-on demonstrations with sample rifles would have allowed the CR to experience the difference in weapon length, weapon weight, recoil forces, etc. These modules could not be conducted due to limited coordination time, logistical constraints, and limited face time with the CR participants.

5.5 Future Work

While the current project represents a big step towards the acquisition of a new CRR, future work is still recommended.

In continuing the human factors requirements validation for the CRR, efforts should be made to survey more CR to address the limitations of the CR participant sample. CR from 2 CRPG should be surveyed, as well as experienced CR from other CRPG to achieve better proportional representation. This can be conducted by visiting the CR locations as was done for this project or by hosting a CR conference in a single central location with the needed personnel attending.

In traveling to the various CR locations, workshop facilitators had the opportunity to informally interact with a limited number of personnel from various CRPG headquarters. From these interactions it became obvious that CRPG headquarters personnel have valuable insight for the CRR requirements. For example, the guide from one of the CRPG noted that a distinctive rifle would be extremely beneficial in maintaining equipment accountability and tracking lost or stolen equipment. It is anticipated that headquarters personnel would offer a different perspective on CRR requirements than individual CR and could provide valuable additional data on which to base requirements. It is recommended that a conference of select, experienced CRPG headquarters personnel be held to elicit this input.

A review of the CRR requirements with experts in rifle design, marksmanship, and weapons training would be extremely beneficial. While the CR workshop participants were very familiar with their operational needs and environments, and had varying experience with firearms, they were not weapons SMEs. A review of the CRR requirements with weapons SMEs would ensure that the CR requirements are feasible, logical, and desirable, and furthermore would capitalize on the weapons SMEs knowledge of the latest technology in the industry. This review could either be a DLR SME staff check or it could be held in conjunction with the CRPG headquarters personnel requirements feedback in a single conference.

A validation of the requirements with representative rifles, as well as rifles demonstrating select alternatives, is still a necessity. The original plan called for a familiarity range or static display to allow CR participants to experience the different options available; however, this module was cancelled for reasons previously discussed. As a result, CR participants were asked to provide opinions and preferences on features and options which they may not have ever seen before. While the workshop facilitators attempted to explain the features and options in question, it was difficult for CR to form their own opinions. CR participants were instructed to indicate that they were unsure or

had no preference in these situations. It is therefore recommended that a review of the proposed requirements be conducted with CR after firing representative sample rifles that potentially meet the requirements and demonstrate other key options and features. A hands-on evaluation may help identify that only two stock sizes are required, recoil forces are too great on rifles less than 8 lbs, etc. While this familiarity shoot and requirements review would be most efficiently conducted at a single central location, such as the Connaught Range and Primary Training Centre in Ottawa, revisiting the separate CRPGs may have other advantages. It would allow more users to validate the results of this requirements validation method, gain CR support, and demonstrate Land Force support to the CR.

Durability in extreme environments was one of the most important performance criteria to the CR participants. Further description of the extreme environments requirements and testing methodology should be included in the CRR requirements.

In the procurement of the new CRR, a series of user bid evaluation trials with each CRPG or a combined trial with representation from all CRPGs should be conducted to select the eventual CRR design. This testing should account for the environmental and seasonal extremes that are inherent to the CR mission (i.e. summer trial and winter trial).

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Annex A – Canadian Ranger Rifle Statement of Operational Requirement

**STATEMENT OF OPERATIONAL REQUIREMENT
ÉNONCÉ DU BESOIN OPÉRATIONNEL
SMALL ARM REPLACEMENT PROJECT 2
CANADIAN RANGER RIFLE CAPABILITY**

Version 2 – 18 Feb 09

INTRODUCTION

AIM

1. The aim of this Statement of Operational Requirement (SOR) is to define the Canadian Ranger Rifle (CR Rifle) capability.

BACKGROUND

2. The Defence Policy Statement (DPS) 2005 states that "The Canadian Forces (CF) will continue to perform three broad roles: protecting Canadians, defending North America in cooperation with the United States, and contributing to international peace and security."¹⁴ The Canadian Rangers are mentioned by name twice in the DPS. In the section on Domestic Operations, the DPS commits the CF to assist civilian authorities to respond to natural disasters and other incidents, including floods, forest fires, hurricanes and aircraft crashes. The DPS states that, "The Canadian Forces have played an important role in asserting Canadian sovereignty in the North, Arctic and High Arctic.

3. Canada First Defence Strategy – Canadian Forces' contribution to sovereignty and security in the North was announced by the Government of Canada and is quoted at: http://www.forces.gc.ca/site/newsroom/view_news_e.asp?id=2645. The Government of Canada policy includes the following statement: The expansion of the size and capabilities of the Canadian Rangers to provide a stronger and more effective military presence in the North

¹⁴ CANADA'S INTERNATIONAL POLICY STATEMENT, A role of Pride and Influence in the World: DEFENCE page 2. ISBN 0-662-68940-2.

4. The Canadian Ranger “raison d’être” is to conduct activities that enhances and sustains Canada’s sovereignty over the land and navigable waters of the Canadian archipelago. They are contributing to the Defence of North America by providing Canada stationed armed forces in the more remote and isolated parts of Canada. The Canadian Rangers contribute to the "protect Canadians" by being immediately available for employment with the Canadian Forces or other Government Departments in the event of disaster - manmade or natural. The Canadian Rangers also support the Junior Canadian Rangers (JCR) Program, which helps to achieve national and territorial goals through nation building.

DEFICIENCY

5. Canada can no longer sustain the current Ranger Rifle – the .303 Lee Enfield Mk 4 No1 Star in service. The Lee Enfield ceased production at the end of WW II and replacement stocks are no longer available on the international used arms market. The Director Land Procurement has confirmed that the world-wide source of used Lee Enfield is now exhausted and certain replacement parts such as rear sights and magazines are virtually impossible to obtain in the quantities needed. The CF Lee Enfield fleet is being maintained by using parts stripped from other disabled small arms. The age of Lee Enfield rifle, its general condition, the lack of spare parts and the ad hoc method of support combine to convey a very negative message to the members of the Canada Ranger community. The overall deficiencies of the Lee Enfield rifle are presented in the LF Future Direct Fire Capability Study. The Appendix pertaining to the Canadian Ranger rifle is attached to this SOR.

6. Terms and Definitions. The terms and definitions used in this SOR are presented below:

- a. Essential. An essential requirement is a criterion that must be met if a contender’s rifle is to be considered for selection. Performance thus designated as essential is deemed to be so important that even if the contender’s rifle meets all other criteria and all the desirable criteria, the rifle will be rejected as not meeting this SOR. In this document the terms “must”, “will” or “shall” are to be determined synonymous with the word essential.
- b. Desirable. Desirable criteria are used to promote a more sensitive evaluation of the contending rifles that already meet the essential performance requirements. A desirable criterion describes a requirement where performance better than the stated essential level is deemed to have significant value to the Canadian Ranger Rifle concept. In this SOR the words “should” or “could” are synonymous with desirable.
- c. Essential Criteria Achievable. The stipulation for an essential criterion presumes that it is achievable at reasonable cost. However, should any criterion subsequently be determined to be impractical for technical or budgetary reasons, the Project Sponsor, the Chief of the Land Staff, will reassess that criterion.

7. **Fit for Function.** The Lee Enfield has been in continuous service with the Canadian Rangers since 1947. Based on this fact the Canadian Ranger must fit its intended purpose, which means that in the view of the majority of Canadian Rangers the rifle is an acceptable replacement for the Lee Enfield rifle. The essential characteristics of this capability are provided at Table 1.

Targets and Operational Scenarios

8. The primary function of the Canadian Ranger Rifle capability is the rifle is a military small arm or an anti-personnel weapon. In most cases it will be used to deter aggression or violent behaviour. The secondary role of this capability is to provide the Canadian Ranger as self-defence capability against large predators and finally the Ranger may use this capability for his/her personal survival. The following is applicable to this requirement:

- a. Dismounted Personnel Target. A trained Ranger must be capable of hitting and incapacitating a dismounted personnel target at 300 m in accordance with STANG 4512¹⁵ under a wide number of environmental conditions from the prone supported position;
- b. Predators. The Canadian Ranger must be capable, when required, of self-defence against the largest carnivores;
- c. Survival. The Canadian Ranger rifle must be sufficiently accurate and effective to kill a variety of game found in Northern Canada including large mammals;
- c. Operational Locations. Canadian Rangers are station and operate year-round on Canada's East, West and North coasts. In addition, Canadian Rangers can be expected to operate in Canada's North, Arctic and High Arctic regions.

Table 1 – Canadian Ranger Rifle Capabilities

Performance Characteristic	Substantiation	Comment
Bolt Action	<p>The requirement for a bolt action rifle is based on:</p> <p>The Canadian Rangers operate in one of the harshest environments on earth. Six</p>	A bolt-action rifle takes less maintenance and has fewer moving parts than any other small arm except for a hinged shotgun.

¹⁵ See AC/225-D1365 STANAG 4512 (Edition 1) dated 10 Nov 95

	decades of operational experience has demonstrated that the most reliable loading mechanism (action) under these conditions for a small arm is a bolt action rifle.	Canadian Rangers do not have regular access to the CF support system.
7.62 X 51mm ¹⁶ (.308 Win Calibre)	<p>The Canadian Rangers are a component of the CF and as such shall be equipped with a military rifle that meets international conventions to which Canada is a signatory. This means that the rifle and the corresponding ammunition must meet:</p> <ul style="list-style-type: none"> ➤ The Declaration of St Petersburg 1868; ➤ The Hague Convention of 1899; ➤ The Hague Convention of 1907; ➤ Law of Armed Combat <p>The Canadian Ranger Rifle must fire a standard CF or NATO 7.62mm cartridge.</p> <p>The rifle must also fire commercial .308 calibre ammunition. The .308/ 7.62mm calibre provides for a range of ammunition types that meet the Ranger's diverse roles including soft point and Full Metal Jacket ammunition.</p>	<p>The Canadian Ranger will use this capability for self-protection against predators, as a survival tool and when required to carry out missions that may require the use of lethal force.</p> <p>Analysis and advice from Environment Canada, the Royal Canadian Mounted Police and wildlife experts indicate that the 7.62mm (.308 cal) cartridge with soft point ammunition is appropriate to the Ranger's role.</p>
Robust sling Swivels	The Ranger will frequently sling his/her rifle while driving a ski doo, all terrain vehicle, or traveling, by dog-sled or hiking on foot. It is essential that the sling swivels be sufficiently robust to withstand extremely harsh handling over an extended period.	The sling attachment points will be subjected to various levels of stress and weight loading under very low temperature.
Iron Sights	It is mandatory that the Ranger rifle be fitted with robust and protected "iron" sights. The extreme temperatures experienced during Ranger operations make optical sights impractical and	The sights of the rifle are arguably the most vulnerable component and as such the original equipment manufacture should pay

¹⁶ The Director Land Requirement will reserve judge on the final selection of the calibre should it be demonstrated that a 7.62mm rifle does not meet the Ranger's overall requirement.

Annex A:
CRR SOR

	subject to fogging and premature destruction.	special attention to this requirement.
Extractor	The extractor must allow direct round chambering. Under emergency conditions the Ranger must be capable of loading a cartridge into the breech by “dropping” a round directly on the magazine plate and driving the bolt close. The extractor and the other parts that comprise the bolt and breech mechanism must be capable of withstanding repeated emergency loading drills.	The requirement is for a military small arm that is intended, when necessary, to be used in close combat.
Minimum Maintenance	The CR Rifle must require minimum maintenance to continue to operate.	The care and maintenance given to the CR Rifle will vary among individual members of the CR. What is constant is that the majority will operate under some of the most brutal operational and environmental conditions on the planet. A rifle that requires substantial maintenance to function properly will be rejected by the Rangers.
Robust Stock	A rifle normally has a butt and forestock that is made of wood, metal or a synthetic product.	The stock of the Ranger’s rifle must be extremely robust and built to withstand the rigours of extended life in a harsh service environment
Transportation Case (Hard Case)	<p>The Ranger resides in and operates from his/her local community. The tradition of leaving houses, automobiles and other vehicles unlocked in the North, Arctic and High Arctic continues.</p> <p>The OEM shall provide a suitable hard case that can be securely locked and when required secured to the interior of a building or residence to create a secure rifle rack.</p>	The requirement for a Hard Case would provide deterrence to theft and the inappropriate use of DND property by non CF personnel. The Hard Case will assist the CR safe- guard his/her rifle.
Carrying Case (Soft Case)	The Ranger will occasionally travel by aircraft, motor vessel or other means of transportation used in Canada including	

	<p>commercial airlines and buses etc. It is essential that the Ranger be provided with a durable rifle carrying case that will secure and protect DND property.</p> <p>The OEM shall provide a suitable soft carrying case equipped with a sling and a carrying handle at the point of balance.</p>	
Small arm identification	The Royal Canadian Mounted Police (RCMP) and other authorities in the North, Arctic and High Arctic must be able to immediately identify a Canadian Ranger and his/her rifle by its distinctive colour and configuration given that the Ranger often travels in civilian clothes because he/she is not provided with a CF uniform.	The rifle must be distinctive and easily identifiable as the Canadian Ranger rifle so it is easily distinguishable at a distance. This feature would minimize its use by non Canadian Rangers and reinforce its symbolic importance to the members.
Protected Barrel and components	Special measure will be recommended to protect the barrel, rifle bore and other components of the rifle from rust and premature deterioration because of the harsh environmental conditions	<p>Failure to adopt protective measures means that the in-service life of the rifle will be reduced and NP cost to sustain the CR Rifle fleet will be higher.</p> <p>The second consequence is that rifle will fail to act as a “motivator” and a source of pride for Ranger..</p>

7. Requirements Table.

Table 2 -

Item		Mandatory	Desirable
2.	Performance Characteristic		
2.a.	The CR Rifle must be capable of achieving a probability of a hit (P Hit) when fired in a prone supported position of 0.9 against a standing STANAG 4512 ¹⁷ unprotected human target at 300 m from the first round.	X	

¹⁷ NATO AC/225-D/1365 STANAG 4512 Edition 1 Dismounted Personnel Target Original English 10 Nov 95

2.b.	The CR Rifle must have a magazine capacity of 10, 7.62mm cartridges. ¹⁸ The magazine must be detachable from the rifle.	X	
2.c.	The CR Rifle must be capable of firing either Full Metal Jacket CF ammunition commercial .308 cal ammunition.	X	
2.d.	The CR Rifle must be a bolt-action, magazine-fed rifle of a proven design.	X	
2.e.	The CR Rifle shall be fitted with rear and front iron sights. ¹⁹	X	
2.f.	It is essential that a CF weapon technician can remove and replace the front and rear sights and sight guards (protectors) should they become damaged.	X	
2.g.	The CR Rifle should be capable of mounting an optional optical sight.		X
2.h.	The CR Rifle must not weight more than a fully loaded .303 Cal Lee Enfield rifle less the bayonet.	X	
2.i.	The CR Rifle should weight less than a fully loaded .303 Lee Enfield rifle.		X
2.j.	The CR Rifle is intended to be used by a military component of the CF and as such all components of the CR Rifle shall be completely interchangeable as described in NATO Document AC/225 Panel III D/14 Edition 1992, Para 2.23.1 to 2.23.4 inclusive. Any component that cannot be interchanged must bear the weapon serial number to avoid the incorrect use of parts.	X	
2.k.	The CR Rifle must be designed so that there are no exposed parts that could injure the Ranger.	X	
2.l.	The Ranger should be capable of loading five rounds in the magazine in five second.		X
2.m.	In an emergency the Ranger must be capable of opening the bolt and inserting a cartridge into	X	

¹⁸ Requirement for a detachable magazine was validated at the informal meeting at Connaught Range 19 Sep 08.

¹⁹ The meeting at Connaught Range on 19 Sep 08 pointed to the need to conduct a serious and detailed investigation into the type of iron sight to be provided.

	the breech and preparing the rifle to fire without the use of the magazine.		
2.n.	The CR Rifle must be designed in a way that it can be effectively operated by 5% to 95 % of the male and female Ranger population.	X	
2.o.	The CR Rifle should include a device that visibly indicates when the rifle is ready to fire.		X
2.p.	CR Rifle must have a distinctive colour and identifying features such as a logo, emblem or crest.	X	
2.q.	CR Rifle must have a means to adjust the length of the butt stock to accommodate Rangers of different body sizes. The rifle must be equipped with a recoil-absorbing butt to reduce the recoil forces on Rangers with a small stature.	X	
2.r.	CR Rifle must have a means to adjust the height of the comb on the butt stock to accommodate Rangers of different body sizes and the fact that over the course of the year the clothing worn by the Ranger will vary greatly.	X	
2.s.	The rifle must be capable of attaching a adjustable bipod. The bipod will allow the Ranger to support the rifle during surveillance tasks.	X	
2.t.	The trigger guard musts accommodate a glove hand.	X	
2.u.	The rifle must be equipped with a manual safety that can be operated with a gloved hand.	X	
2.t.	The rifle will be provided with a sub-calibre training device that is capable of firing a .22 calibre Long Rifle cartridge.	X	
2.u	The rifle must be provided with as two-stage trigger configuration similar to the one now used on the Lee Enfield.	X	
3.	Protection		
3.a.	The CR Rifle front and rear sight must be protected from accidental damage.	X	
3.b.	The CR Rifle must be provided with robust butt and fore stock that is highly resistant to accidental and environmental damage.	X	

3.c.	The sling swivels on the CR Rifle must be extremely robust and capable of withstanding harsh wear and tear over a prolonged period.	X	
3.d.	The CR Rifle hard carrying case must be securable, waterproof to a depth of one metre. The CR Rifle hard carrying case must accommodate the rifle, six 10 round magazines, cleaning kit/tools and the optional sight.	X	
3.e	The rifle should be provided with a suitable hard case that contains the Canadian Ranger insignia and constructed in a distinctive colour scheme.		X
3.f.	It is essential that the CR Rifle be provide a suitable soft case that can be locked, when required.		
3.g	The CR Rifle shall be capable of surviving and operating in the climatic regions described by A1, A2, A3, B1, B2, B3 C0, C1, C2, C3 of STANAG 2895.	X	
3.h	The CR Rifle shall be capable of being transported (as loose and secured cargo) using SMP vehicles and other vehicles typically used by the Canadian Rangers including skidoos, trailers and sleds.	X	
3.i	The rifle stock must be made of the appropriate synthetic material.	X	
3.j	The Ranger rifle will be provided with a combat knife.	X	
4.	User Acceptance		
4.a.	Comparative Testing. Comparative testing of candidate rifle will be a key component in the selection of the CR Rifle. It is anticipated that the following test activities will be undertaken.	X	
4.b.	Range Testing. Live fire testing on a range will be conducted to determine the performance characteristics of the candidate rifle. Live fire testing will take place under a variety of climatic conditions.	X	
4.c	User Trials. Candidate CR Rifles will subject to tactical handling and compatibility trials to ensure that the rifle is capable of meeting the Ranger's requirements in a tactical setting.	X	

4.d.	The CR Rifle will be provided with the ancillary items listed under the heading Deliverables below.	X	
4.e.	The CR Rifle shall be equipped with a cleaning kit.	X	
4.f.	The CR Rifle cleaning kit must be as compact as possible	X	
4.g.	The CR Rifle must be provided with a robust adjustable sling.	X	
5.	Security and Safety		
5.a.	The CR Rifle must include a manual-operated safety device that will prevent the rifle from being fired.	X	
5.b	It must be possible to lock the hard case. Locks and keys must be provided.	X	
6	Sustainability.		
6.a.	The CR Rifle is a military small arm and as such is similar to the C7A2 assault rifle in terms of fit, form and function. It shall be treated like the other SARP small arms in terms of in-service support. That is the CR Rifle shall have the capability of guaranteed sustainability throughout its in-service life. This capability includes the production of all small arms parts and complete weapons, overhaul and maintenance of the rifle, life cycle material management of the rifle, and production of ammunition for the rifle. Guaranteed sustainability is only possible within the Canadian Defence Industrial Base. Therefore, it is essential that production of the CR Rifle and its ammunition, its overhaul and maintenance and its life cycle material management be done in Canada.	X	

Delivery Requirements

Quantity. The CF has a requirement for up to approximately _____ CR Rifles plus ancillaries. This number will be refined once additional information is assessed such as the Original Equipment

Manufacturer's capability to manufacture identical replacement rifles, the annual anticipated National Procurement cost to sustain the fleet and the requirements of other components of the CF. The project now anticipates the need to acquire the following:

Table 3

Serial	Description	Quantity	Substantiation
1	Rifle Complete with EIS		Equip five Canadian Ranger Patrol Groups at an anticipated strength of 5,000 for current operations.
2	Growth Ranger Program		Anticipate growth of the Ranger program over the next 30 years.
2	Support to Other Government Departments		
5	Attrition Rifles		Figure is based on the anticipated loss of 100 rifles per year for 30 years of the Ranger program.
6	Logistics Stocks		Ten percent of the rifles in operational use.
7	Maintenance Stock		Ten percent of the rifles in operational use.
8			
9			

Quality. The required quality is defined elsewhere in this SOR. The CR Rifle quality being described in this SOR in terms of performance, maintainability, durability and availability, as well as compliance with safety policy detailed in the SOR are justified because:

Isolation. The Rangers frequently operate at long distances from their patrol base without direct communication or without any form of logistic support. In most instances there will no way to replace or repair the Ranger's rifle should it become inoperable while the Ranger is on patrol.

Logistics Base. There are no logistic bases in Northern, Arctic and High Arctic communities with the exception of Yellowknife. There are no logistics or maintenance spares deployed forward to the Ranger's community and as such the Ranger's rifle might not be replaced or repaired until the next visit of a member of the Ranger Patrol Group Headquarters, which except for Yellowknife, are located in the south of Canada.

Confidence. The Ranger must have absolute confidence that the CR Rifle will operate as specified under harsh environmental and operational conditions for its intended service life. Unlike many small arms in garrison locations in southern Canada the Ranger will frequently transport and use his/her rifle when moving on the land.

Location. The OEM will deliver the CR Rifle to CF depots under the terms of the contract. The CR Rifle will then be delivered to Canadian Ranger Patrol Group Headquarters and finally transported to the Ranger's community under the control of the Canadian Ranger Patrol Group HQ.

Deliverables. The CR Rifle is a military system that comprises:

Item	Qty	Comment
Rifle 7.62mm bolt action	1	
Magazine	6	
Sling swivel and sling	1	
Operator's manual	1	The operator manual must be written in English and French. The manual will be designed for use by Canada aboriginal people.
Security locking device	1	Ideally the rifle will incorporate a trigger lock device or some other system that will prevent the rifle from firing when not in use.
Carrying Case (Soft Case)	1	
Transportation Case (Hard Case)	1	
Cleaning kit with carrier	1	The cleaning kit must contain sufficient supplies to satisfy the individual Ranger's requirement for a period of one year.
Sub-Calibre Training Device Kit	1	Development will be required to determine whether a SCTD can be delivered as part of the rifle.
Combat Knife and Carrier	1	A bayonet will not be provided. A combat knife shall be provided in the Hard Case as part of the rifle's Equipment Issue Scale
Paddle Locks, trigger locks or equivalent	2	

Annex B – Detailed Workshop Results

Table 11: Canadian Ranger Rifle Weapon Use

How often do you shoot with the .303 Lee Enfield?		
n=122	Frequency Count	% Respondents
1. Annually	42	34.4%
2. Semi-annually	39	32.0%
3. Monthly	35	28.7%
4. Weekly	4	3.3%
5. Daily	2	1.6%
How many rounds a year do you shoot with the .303 Lee Enfield?		
n=98	Frequency Count	% Respondents
1. <100	23	23.5%
2. 101 - 200	42	42.9%
3. 201 - 300	13	13.3%
4. 301 - 400	9	9.2%
5. >400	11	11.2%
During which activities do you use the .303 Lee Enfield? (list all that apply)		
n=119	Frequency Count	% Respondents
1. Military	109	91.6%
2. Hunting	53	44.5%
3. Other	23	19.3%
What posture do you use most when you shoot with the .303 Lee Enfield?		
n=82	Frequency Count	% Respondents
1. Prone unsupported	33	40.2%
2. Prone supported	16	19.5%
3. Kneeling unsupported	9	11.0%
4. Kneeling supported	3	3.7%
5. Standing unsupported	14	17.1%
6. Standing supported	7	8.5%
Is your .303 Lee Enfield your primary hunting rifle?		
n=99	Frequency Count	% Respondents
1. Yes	29	29.3%
2. No	70	70.7%
Do you carry any other rifles besides your .303 Lee Enfield while on patrol?		
n=82	Frequency Count	% Respondents
1. Yes	23	28.0%
2. No	59	72.0%
How do you transport the .303 Lee Enfield? (list all that apply)		
n=125	Frequency Count	% Respondents
1. Snowmobile	75	60.0%
2. BV 206	5	4.0%
3. Boat	75	60.0%
4. ATV	50	40.0%
5. Civilian vehicle	82	65.6%
6. Dog sled	4	3.2%
7. Other	19	15.2%
Where do you store your .303 Lee Enfield?		
n=130	Frequency Count	% Respondents
1. At home	88	67.7%
2. At patrol base	15	11.5%
3. At CRPG HQ	26	20.0%

Annex B: Detailed Workshop Results

4. Other	1	0.8%
How often do clean your .303 Lee Enfield?		
n=102	Frequency Count	% Respondents
1. Daily	2	2.0%
2. Weekly	7	6.9%
3. Monthly	38	37.3%
4. Semi-annually	42	41.2%
5. Annually	13	12.7%
Do you clean the Lee Enfield after each use?		
n=127	Frequency Count	% Respondents
1. Yes	97	76.4%
2. No	30	23.6%
What preventative cleaning measures do you take with the .303 Lee Enfield? (list all that apply)		
n=126	Frequency Count	% Respondents
1. Bore cleaning	103	81.7%
2. Trigger spray solvent	35	27.8%
3. Rust prevention lubricants	75	59.5%
4. Other oils and lubricants	76	60.3%
5. Dry cleaning solvents	21	16.7%
6. Other	9	7.1%
What targets do you shoot with the .303 Lee Enfield? (list all that apply)		
n=123	Frequency Count	% Respondents
1. Targets (figure 11, other)	116	94.3%
2. Personnel	8	6.5%
3. Small game (rabbits, pheasants, ducks)	54	43.9%
4. Large game (deer, bear, caribou)	28	22.8%
5. Other materiel	1	0.8%
On average, how far away are the targets that you shoot with the .303 Lee Enfield?		
n=122	Frequency Count	% Respondents
1. <50m	2	1.6%
2. 51 – 100m	62	50.8%
3. 101 – 200m	38	31.1%
4. 201 – 300m	8	6.6%
5. 301 – 400m	8	6.6%
6. >400m	4	3.3%
What type of sight do you use with your .303 Lee Enfield?		
n=110	Frequency Count	% Respondents
1. Iron Sight	107	97.3%
2. Optical Sight	2	1.8%
3. Other	1	0.9%
What parts have broken on your Lee Enfield? (list all that apply)		
n=74	Frequency Count	% Respondents
1. Iron sight	26	35.1%
2. Magazine	40	54.1%
3. Buttstock	8	10.8%
4. Forestock	14	18.9%
5. Receiver/action	8	10.8%
6. Barrel	12	16.2%
7. Sling swivel	14	18.9%
8. Sling	4	5.4%
9. Other	9	12.2%

**Annex B:
Detailed Workshop Results**

Table 12: Canadian Ranger Rifle Basic Technical Requirements

The CRR should it be a?		
n=132	Count	% Respondents
1. Single shot	6	4.5%
2. Manual Repeater	88	66.7%
3. Semi-automatic	31	23.5%
4. No preference	7	5.3%
What type of action should the CRR have?		
n=133	Count	% Respondents
1. Bolt	101	75.9%
2. Lever	13	9.8%
3. Automatic/ Semiautomatic	12	9.0%
4. No preference	7	5.3%
Canadian Ranger Rifle Action		
What type of bolt action design should the CRR be?		
n=126	Count	% Respondents
1. Lee Enfield (Push feed)	59	46.8%
2. Mauser (Control feed)	18	14.3%
3. Hybrid (controlled round push feed)	18	14.3%
4. No preference	31	24.6%
If the CRR is a bolt action rifle, should it have a bolt that is?		
n=133	Count	% Respondents
1. Cycled from the right only	26	19.5%
2. Right and left-handed models	94	70.7%
3. No preference	13	9.8%
Canadian Ranger Rifle Receiver Trigger Safety Magazine		
The CRR should have a safety system that?		
n=133	Count	% Respondents
1. Has a cocking indicator	110	82.7%
2. No cocking indicator	4	3.0%
3. No preference	19	14.3%
What calibre should the CRR be?		
n=133	Count	% Respondents
1. .223 (5.56mm)	10	7.5%
2. .300 Winchester	5	3.8%
3. .30-06	20	15.0%
4. .308 Winchester (7.62mm)	66	49.6%
5. .338 Winchester	2	1.5%
6. Other	8	6.0%
7. No preference	22	16.5%
Does the weapon need to be able to fire commercial as well as military rounds?		
n=133	Count	% Respondents
1. Yes, both types necessary	90	67.7%
2. No, only CF rounds (full metal jacket)	12	9.0%
3. No, only commercial rounds	3	2.3%
4. No preference	28	21.1%
The CRR should have a magazine system that has a capacity for:		
n=133	Count	% Respondents
1. 3 rds	0	0.0%
2. 4 rds	3	2.3%
3. 5 rds	22	16.5%
4. 6 rds	6	4.5%
5. 10 rds	79	59.4%
6. Other	13	9.8%
7. No preference	10	7.5%

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How long should it take you to load 5 rounds in the magazine?		
n=110	Count	% Respondents
1. <5 seconds	23	18.1%
2. 5 – 10 seconds	56	44.1%
3. 10 – 15 seconds	21	16.5%
4. >15 seconds	6	4.7%
5. No preference	21	16.5%
The CRR should have a magazine system that:		
n=127	Count	% Respondents
1. Is detachable	93	73.2%
2. Fixed/Internal	15	11.8%
3. No preference	19	15.0%
The CRR should have a receiver system that:		
n=127	Count	% Respondents
1. Allows user to manually load one manually load one cartridge direct into the chamber	81	63.8%
2. Does not allow manual feed (controlled feed)	14	11.0%
3. No preference	32	25.2%
Should you be able to carry extra rounds of ammunition in the butt of the CRR?		
n=132	Count	% Respondents
1. Yes	28	21.2%
2. No	66	50.0%
3. No preference	38	28.8%
Canadian Ranger Rifle Stock – Style Shape Materials Finish		
The CRR should have a stock grip shape similar to?		
n=132	Count	% Respondents
1. Straight grip	19	14.4%
2. Semi-pistol grip	62	47.0%
3. Vertical grip	5	3.8%
4. Thumb-hole grip	10	7.6%
5. Pistol grip	18	13.6%
6. No preference	18	13.6%
The CRR should have a butt stock cheek shape similar to?		
n=102	Count	% Respondents
1. Classical style (straight)	36	35.3%
2. Monte Carlo (raised)	49	48.0%
3. Thumb-hole style	4	3.9%
4. Other	1	1.0%
5. No preference	12	11.8%
The CRR should have the ability to?		
n=133	Count	% Respondents
1. Adjust the pull length	78	58.6%
2. Fixed length	25	18.8%
3. No preference	30	22.6%
Should the CRR have a foldable buttstock?		
n=133	Count	% Respondents
1. Yes	19	14.3%
2. No	85	63.9%
3. No preference	29	21.8%
The CRR should have the ability to?		
n=126	Count	% Respondents
1. Adjust the height of the cheek piece/comb	32	25.4%
2. Fixed position	51	40.5%
3. No preference	43	34.1%
The CRR should have a recoil absorbing system?		
n=127	Count	% Respondents
1. Yes	83	65.4%

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2. No	17	13.4%
3. No preference	27	21.3%
The CRR stock should be made from the following materials?		
n=133	Count	% Respondents
1. Hardwood	34	25.6%
2. Laminated wood	6	4.5%
3. Synthetic	43	32.3%
4. Composite metal/synthetic	23	17.3%
5. No preference	27	20.3%
The CRR stock should have the following appearance?		
n=133	Count	% Respondents
1. Camouflage pattern	36	27.1%
2. Grey synthetic	12	9.0%
3. Black synthetic	26	19.5%
4. Green synthetic	12	9.0%
5. Wood	27	20.3%
6. Other	4	3.0%
7. No preference	16	12.0%
Canadian Ranger Rifle Barrel length		
The CRR should not be longer than?		
n=127	Count	% Respondents
1. 39"	9	7.1%
2. 40"	14	11.0%
3. 41"	7	5.5%
4. 42"	24	18.9%
5. 43"	10	7.9%
6. 44.5"	28	22.0%
7. No preference	35	27.6%
The CRR should have a barrel that is?		
n=126	Count	% Respondents
1. 20" long	7	5.6%
2. 22" long	22	17.5%
3. 24" long	25	19.8%
4. 26" long	34	27.0%
5. No preference	38	30.2%
Canadian Ranger Rifle Sights		
The CRR should be equipped with an?		
n=116	Count	Percentage
1. Iron sight only	21	18.1%
2. Iron sight with provision for an optical sight	52	44.8%
3. Optical sight with back-up iron sights	23	19.8%
4. No preference	20	17.2%
The CRR iron sights should be?		
n=116	Count	% Respondents
1. Protected (hood/guards)	78	67.2%
2. Open	24	20.7%
3. No preference	14	12.1%
The CRR iron sight should be a?		
n=100	Count	% Respondents
1. Peep sight/ghost ring rear sight and square front post sight	32	32.0%
2. Shallow V rear sight and coloured front bead sight	28	28.0%
3. Similar to .303 Lee Enfield	22	22.0%
4. Other	1	1.0%
5. No preference	17	17.0%
The CRR optical sight mount, should it be?		
n=114	Count	% Respondents

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1. Compatible with the NATO standard rail	43	37.7%
2. Compatible with recreational scope mounts	34	29.8%
3. Other	1	0.9%
4. No preference	36	31.6%
Miscellaneous - Take-down? Cleaning kit chamber		
The CRR should be able to be?		
n=125	Count	% Respondents
1. Able to take apart (take-down) for storage and transport	23	18.4%
2. Fixed	71	56.8%
3. No preference	31	24.8%
The CRR should have?		
n=131	Count	% Respondents
1. An internal storage compartment for cleaning supplies	31	23.7%
2. A separate cleaning kit	44	33.6%
3. Storage compartment and cleaning kit	33	25.2%
4. No preference	23	17.6%
CCR Ancillary Equipment		
Should the CRR come with a sling?		
n=131	Count	% Respondents
1. Yes	112	85.5%
2. No	6	4.6%
3. No preference	13	9.9%
Should the CRR come with a combat knife?		
n=131	Count	% Respondents
1. Yes	64	48.9%
2. No	52	39.7%
3. No preference	15	11.5%
Should the CRR come with?		
n=131	Count	% Respondents
1. A hard case	51	38.9%
2. A soft case	17	13.0%
3. Both a hard and a soft case	53	40.5%
4. No case	1	0.8%
5. No preference	9	6.9%
CCR Identification		
The CRR should have? (indicate all that apply)		
n=89	Count	% Respondents
1. Distinctive logo / emblems/crests	62	69.7%
2. Distinctive stock colour	17	19.1%
3. Distinctive barrel	10	11.2%
Weight		
The CRR should weigh		
n=131	Count	% Respondents
1. More than the Lee-Enfield	3	2.3%
2. Equal to the Lee-Enfield	23	17.6%
3. Less than the Lee-Enfield	88	67.2%
4. No preference	17	13.0%
The CRR should not weigh more than?		
n=125	Count	% Respondents
1. 7 lbs	24	19.2%
2. 7.5 lbs	22	17.6%
3. 8 lbs	27	21.6%
4. 8.5 lbs	11	8.8%
5. 9.0 lbs	17	13.6%
6. 9.5 lbs	4	3.2%
7. 10 lbs	1	0.8%

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8. 10.5 lbs	2	1.6%
9. No preference	17	13.6%

Table 13: Canadian Ranger Rifle Detail Technical Requirements

CRR Action – Type, Bolt (Design Materials)		
If the CRR is a bolt action rifle should it have a bolt throw that is?		
n=29	Count	% Respondents
1. Short action (.308)	19	65.5%
2. Long action	2	6.9%
3. No preference	8	27.6%
If the CRR is a bolt action rifle should it have a bolt locking angle that is?		
n=70	Count	% Respondents
1. 90° (Mauser)	6	8.6%
2. 70° (Tikka)	5	7.1%
3. 60° (Browning A Bolt/Lee Enfield)	31	44.3%
4. 54° (Weatherby)	9	12.9%
5. Straight (Blaser)	2	2.9%
6. No preference	17	24.3%
If the CRR is a bolt action rifle should it have a bolt knob that is?		
n=68	Count	% Respondents
1. Over sized bulb	6	8.8%
2. Flattened angled sphere	16	23.5%
3. Ball	21	30.9%
4. Cone	6	8.8%
5. No preference	19	27.9%
If the CRR is a bolt action rifle should it have a bolt knob that is?		
n=69	Count	% Respondents
1. Extended further out from the body	3	4.3%
2. Normal	61	88.4%
3. No preference	5	7.2%
If the CRR is a bolt action rifle should it have a bolt knob that is?		
n=70	Count	% Respondents
1. Straight out from the receiver	36	51.4%
2. Angled back from the receiver	17	24.3%
3. No preference	17	24.3%
CRR Receiver Trigger		
Should the trigger guard be?		
n=70	Count	% Respondents
1. Fixed	48	68.6%
2. Removable (for compatibility with gloves)	17	24.3%
3. No trigger guard	0	0.0%
4. No preference	5	7.1%
The CRR should have a trigger that is?		
n=70	Count	% Respondents
1. Single stage	18	25.7%
2. Double stage (short take-up and target pull)	48	68.6%
3. No preference	4	5.7%
The CRR should have a trigger that is?		
n=70	Count	% Respondents
1. Adjustable pull force	42	60.0%
2. Set pull	21	30.0%
3. No preference	7	10.0%
Should the trigger have?		
n=70	Count	% Respondents

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1. Short stroke	38	54.3%
2. Long stroke	17	24.3%
3. No preference	15	21.4%
CRR Safety Systems		
Should the CRR have a safety system that?		
n=70	Count	% Respondents
1. 3 position system A-locks the bolt and striker; B-Locks the trigger but allows the opening of the bolt; and C-Ready/Fire	22	31.4%
2. 2 position safety – A Safe; B –Ready/Fire	41	58.6%
3. No preference	7	10.0%
The CRR should have a safety system that?		
n=70	Count	% Respondents
1. Has tang style safety	15	21.4%
2. Cross bolt safety	15	21.4%
3. Wing safety	13	18.6%
4. No preference	27	38.6%
Should the CRR have the safety that is located?		
n=69	Count	% Respondents
1. On the right side	18	26.1%
2. On the left side	12	17.4%
3. On the top	26	37.7%
4. No preference	13	18.8%
If equipped with a 3 position wing safety, the system should have?		
n=40	Count	% Respondents
1. A horizontal wing safety	6	15.0%
2. A vertical wing safety	11	27.5%
3. No preference	18	45.0%
4. Not Applicable	5	12.5%
Should the CRR have a safety that is operable with gloves?		
n=69	Count	% Respondents
1. Yes	54	78.3%
2. No	4	5.8%
3. No preference	11	15.9%
Should the CRR come equipped with a storage trigger lock?		
n=69	Count	% Respondents
1. Yes	61	88.4%
2. No	5	7.2%
3. No preference	3	4.3%
Built in Trigger Lock?		
n=29	Count	% Respondents
1. Yes	23	79.3%
2. No	2	6.9%
3. No preference	4	13.8%

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Detailed Workshop Results**

Ammunition System		
The CRR should have a magazine system that is:		
n=67	Count	% Respondents
1. Box-style magazine	59	88.1%
2. Rotary/drum style magazine	1	1.5%
3. No preference	7	10.4%
The CRR should have a magazine system that is made from:		
n=68	Count	% Respondents
1. Steel	30	44.1%
2. Polymer	26	38.2%
3. No preference	12	17.6%
The CRR should come with:		
n=69	Count	% Respondents
1. 1 magazine	5	7.2%
2. 2 magazines (i.e. 1 spare)	42	60.9%
3. 3 magazines (i.e. 2 spares)	20	29.0%
4. No preference	2	2.9%
The CRR should have a magazine system that can be?		
n=69	Count	% Respondents
1. Loaded manually only while attached	7	10.1%
2. Loaded while detached	57	82.6%
3. No preference	5	7.2%
The CRR should have a magazine release system that is located?		
n=69	Count	% Respondents
1. Forward of the trigger	32	46.4%
2. On the magazine housing	25	36.2%
3. Other	1	1.4%
4. No preference	11	15.9%
How long should it take you to load 5 rounds in the magazine?		
n=46	Count	% Respondents
1. <5 seconds	4	8.7%
2. 5 – 10 seconds	38	82.6%
3. 10 – 15 seconds	1	2.2%
4. >15 seconds	2	4.3%
5. No preference	1	2.2%

Annex B: Detailed Workshop Results

CRR Stock – Style Shape Materials Finish		
The CRR should have the following forearm shape?		
n=40	Count	% Respondents
1. Full length similar to the Lee Enfield	8	20.0%
2. Hunting style	29	72.5%
3. No preference	3	7.5%
If fixed length, the CRR should be available in?		
n=68	Count	% Respondents
1. One fixed length	10	14.7%
2. Multiple fixed lengths	45	66.2%
3. Not required	2	2.9%
4. No preference	11	16.2%
If multiple fixed lengths, the CRR should be available in?		
n=41	Count	% Respondents
1. Two sizes (12" and 15")	9	22.0%
2. Three sizes (12", 13.5" and 15")	23	56.1%
3. Other	7	17.1%
4. No preference	2	4.9%
If the CRR should have an adjustable pull length, the mechanism should be?		
n=69	Count	% Respondents
1. Fixed pads	34	49.3%
2. Adjustable	22	31.9%
3. Not required	5	7.2%
4. No preference	8	11.6%
The CRR should also have the ability to?		
n=69	Count	% Respondents
1. Adjust the angle of the butt stock vertically (shims)	20	29.0%
2. Fixed position	26	37.7%
3. No preference	23	33.3%
The CRR should have the ability to?		
n=68	Count	% Respondents
1. Adjust the angle of the butt stock towards the shooter (cast on/off)	20	29.4%
2. Fixed position	31	45.6%
3. No preference	17	25.0%
The CRR should have?		
n=69	Count	% Respondents
1. Recoil pad(s)	56	81.2%
2. No recoil pad	7	10.1%
3. No preference	6	8.7%
The CRR should have?		
n=69	Count	% Respondents
1. Embedded recoil system	13	18.8%
2. No recoil system	29	42.0%
3. No preference	27	39.1%

**Annex B:
Detailed Workshop Results**

Stock		
The CRR stock should be?		
n=69	Count	% Respondents
1. One piece	44	63.8%
2. Two piece	8	11.6%
3. No preference	17	24.6%
The CRR should have the following forearm features?		
n=69	Count	% Respondents
1. Plain	29	42.0%
2. Schnabel (Flared)	10	14.5%
3. Hand stops	16	23.2%
4. No preference	14	20.3%
The CRR should have?		
n=69	Count	% Respondents
1. Palm swell(s)	24	34.8%
2. No palm swell(s)	20	29.0%
3. No preference	25	36.2%
The CRR should have the following forearm cross section shape?		
n=69	Count	% Respondents
1. Similar to the Lee Enfield	12	17.4%
2. Flat oval 3-5" wide	9	13.0%
3. Standard 2½" wide oval	24	34.8%
4. Flat bottom	5	7.2%
5. Pear shaped	1	1.4%
6. No preference	18	26.1%
The CRR stock grip areas should have the following finish?		
n=69	Count	% Respondents
1. Checkering pattern	20	29.0%
2. Smooth	6	8.7%
3. Texture	16	23.2%
4. Rubberized	11	15.9%
5. No preference	16	23.2%
Barrel		
The CRR should have a barrel that is?		
n=69	Count	% Respondents
1. Stainless steel	53	76.8%
2. Nickel	3	4.3%
3. Blued	8	11.6%
4. No preference	5	7.2%
Sights		
If equipped, the CRR optical sight should be a		
n=69	Count	% Respondents
1. C79 Elcan sight (with proper reticle pattern?)	29	42.0%
2. Recreational scope	16	23.2%
3. Close combat sight	7	10.1%
4. Not required	4	5.8%
5. Other	0	0.0%
6. No preference	13	18.8%

Annex B: Detailed Workshop Results

CCR Ancillary Equipment		
Should the CCR come with a bipod?		
n=69	Count	% Respondents
1. Yes	21	30.4%
2. No	41	59.4%
3. No preference	7	10.1%
If the CRR comes with gun case(s), should the cases be lockable?		
n=69	Count	% Respondents
1. Yes	62	89.9%
2. No	2	2.9%
3. No preference	5	7.2%
Should the CCR come with a "drag bag/pack" vice a soft storage case?		
1. Drag bag/pack	31	45.6%
2. Soft storage case	15	22.1%
3. No preference	22	32.4%
Sling		
The CRR should have a?		
n=69	Count	% Respondents
1. Single point sling	4	5.8%
2. Two point sling	52	75.4%
3. Three point sling	9	13.0%
4. No preference	4	5.8%
The sling should be?		
n=69	Count	% Respondents
1. Similar to the Lee Enfield (military pattern)	28	40.6%
2. Padded	38	55.1%
3. No preference	3	4.3%
Should the sling have non-slip material on the pad/webbing?		
n=69	Count	% Respondents
1. Yes	46	66.7%
2. No	8	11.6%
3. No preference	15	21.7%
The sling should be made from?		
n=69	Count	% Respondents
1. Leather	20	29.0%
2. Nylon	24	34.8%
3. Neoprene	8	11.6%
4. No preference	17	24.6%

Annex C – Draft CRR SOR with Comments

	SOR Statement	Validation Exercise Evidence	Revisions / Comments
	Targets and Operational Scenarios		
8.	The primary function of the Canadian Ranger Rifle capability is the rifle is a military small arm or an anti-personnel weapon. In most cases it will be used to deter aggression or violent behaviour. The secondary role of this capability is to provide the Canadian Ranger as self-defence capability against large predators and finally the Ranger may use this capability for his/her personal survival. The following is applicable to this requirement:	CRR role importance ratings: (mean, SD, n) Protection from predators (5.6, 1.59, 132) Hunting/Survival tool (5.5, 1.54, 133) Symbol of Canadian sovereignty / Canadian Rangers (5.4, 1.51, 133) Recruiting tool (4.2, 1.93, 133)	The primary function of the Canadian Ranger Rifle capability is self-defence against large predators and as a hunting and survival tool. The secondary role of this capability is a symbol of Canadian sovereignty and the Canadian Rangers. The following is applicable to this requirement:
8.a.	Dismounted Personnel Target. A trained Ranger must be capable of hitting and incapacitating a dismounted personnel target at 300 m in accordance with STANG 4512 ²⁰ under a wide number of environmental conditions from the prone supported position;	Accuracy of Lee Enfield cited by 16.5% of participants as a best feature and 10.6% as a worst feature See line 8. Accuracy 2 nd of 12 performance requirements (mean=6.0, SD=1.2, n=132) Frequency of typical engagement distances (n=122): <50m (1.6%) 51-100m (50.8%) 101-200m (31.1%) 201-300m (6.6%) 301-400m (6.6%) >400m (3.3%) Importance of CRR engagement distances: (mean, SD, n) <50m (4.6, 2.0, 133) 51-100m (5.0, 1.5, 133) 101-150m (5.2, 1.5, 132)	Predator / Game Animal Target. A trained Ranger must be capable of hitting and incapacitating a predator / game animal (tested with an appropriately sized bull's-eye target) at 300 m as adapted from STANG 4512 under a wide number of environmental conditions from the prone unsupported position;

²⁰ See AC/225-D1365 STANAG 4512 (Edition 1) dated 10 Nov 95

Annex C:
Draft CRR SOR with Comments

	SOR Statement			Validation Exercise Evidence	Revisions / Comments
				151-200m (4.9, 1.7, 133) 201-300m (4.4, 1.9, 133) 301-400m (3.8, 2.1, 133) >400m (3.2, 2.3, 133) 300m requirement will be more stringent in line with second most important performance criteria: accuracy (6.0, 1.2, 132) Frequency of typical shooting postures (n=82): Prone unsupported (40.2%) Prone supported (19.5%) Kneeling unsupported (11.0%) Kneeling supported (3.7%) Standing unsupported (17.1%) Standing supported (8.5%)	
8.b.	Predators. The Canadian Ranger must be capable, when required, of self-defence against the largest carnivores;			See line 8. 31.7% of CR (39 of 123) engage large game Stopping Power 4 th of 12 performance requirements (mean=5.8, SD=1.4, n=132)	No revisions.
8.c.	Survival. The Canadian Ranger rifle must be sufficiently accurate and effective to kill a variety of game found in Northern Canada including large mammals;			See lines 8, 8.a., and 8.b.	No revisions.
8.d.	Operational Locations. Canadian Rangers are station and operate year-round on Canada's East, West and North coasts. In addition, Canadian Rangers can be expected to operate in Canada's North, Arctic and High Arctic regions.			No data. Note CR also operate in inland wilderness areas that are not coastal, northern, arctic, or high arctic (e.g. central British Columbia)	Operational Locations. Canadian Rangers are stationed and operate year-round in Canada's sparsely settled northern, coastal, and isolated areas. These are primarily East, West and North coasts and North, Arctic and High Arctic regions.
	Table 1 - Canadian Ranger Rifle Capabilities				
	<i>Performance Characteristic</i>	<i>Substantiation</i>	<i>Comment</i>		
1.a.	Bolt Action	The requirement for a bolt action rifle is based on:	A bolt-action rifle takes less maintenance and has fewer	Reliability of Lee Enfield cited by 36.5% of participants as a best feature and 13.3% as a worst feature	No revisions.

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	SOR Statement		Validation Exercise Evidence		Revisions / Comments
		<p>The Canadian Rangers operate in one of the harshest environments on earth. Six decades of operational experience has demonstrated that the most reliable loading mechanism (action) under these conditions for a small arm is a bolt action rifle.</p>	<p>moving parts than any other small arm except for a hinged shotgun.</p> <p>Canadian Rangers do not have regular access to the CF support system.</p>	<p>Bolt action of Lee Enfield cited by 13.9% of participants as a best feature and 5.3% as a worst feature</p> <p>Receiver/Action of Lee Enfield noted as frequently broken component (8 of 74)</p> <p>Reliability 1st of 12 performance requirements (mean=6.2, SD=1.2, n=133)</p> <p>Action (n=133): Bolt (75.9%) Lever (9.8%) Automatic/Semi-automatic (9.0%) No preference (5.3%)</p> <p>Loading (n=132): Single shot (4.5%) Manual repeater (66.7%) Semi-automatic (23.5%) No preference (5.3%)</p>	
1.b.	7.62 X 51mm ²¹ (.308 Win Calibre)	<p>The Canadian Rangers are a component of the CF and as such shall be equipped with a military rifle that meets international conventions to which Canada is a signatory. This means that the rifle and the corresponding ammunition must meet:</p>	<p>The Canadian Ranger will use this capability for self-protection against predators, as a survival tool and when required to carry out missions that may require the use of lethal force.</p> <p>Analysis and advice from Environment Canada, the Royal Canadian Mounted</p>	<p>Calibre/Range of Lee Enfield cited by 13.0% of participants as a best feature but calibre (power, rimmed cartridge) cited by 8.0% as a worst feature</p> <p>Stopping Power 4th of 12 performance requirements (mean=5.8, SD=1.4, n=132)</p> <p>Calibre (n=133): .223 / 5.56mm (7.5%) .300 Winchester (3.8%) .30-06 (15.0%)</p>	<p>No revisions. Consider qualification of use of full metal jacket ammunition for training purposes only.</p>

²¹ The Director Land Requirement will reserve judge on the final selection of the calibre should it be demonstrated that a 7.62mm rifle does not meet the Ranger's overall requirement.

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	SOR Statement	Validation Exercise Evidence	Revisions / Comments
	<ul style="list-style-type: none"> ➤ The Declaration of St Petersburg 1868; ➤ The Hague Convention of 1899; ➤ The Hague Convention of 1907; ➤ Law of Armed Combat <p>The Canadian Ranger Rifle must fire a standard CF or NATO 7.62mm cartridge.</p> <p>The rifle must also fire commercial .308 calibre ammunition. The .308/ 7.62mm calibre provides for a range of ammunition types that meet the Ranger's diverse roles including soft point and Full Metal Jacket ammunition.</p>	<p>Police and wildlife experts indicate that the 7.62mm (.308 cal) cartridge with soft point ammunition is appropriate to the Ranger's role.</p> <p>.308 Winchester / 7.62mm (49.6%) .338 Winchester (1.5%) Other (6.0%) No preference (16.5%)</p> <p>Commercial & Military Ammunition (n=133): Both (67.7%) Only military (9.0%) Only commercial (2.3%) No preference (21.1%)</p>	
1.c.	Robust sling Swivels	<p>The Ranger will frequently sling his/her rifle while driving a ski doo, all terrain vehicle, or traveling, by dog-sled or hiking on foot. It is essential that the sling swivels be sufficiently robust to withstand extremely harsh handling over an extended period.</p> <p>The sling attachment points will be subjected to various levels of stress and weight loading under very low temperature.</p> <p>Durability of Lee Enfield cited by 47.0% participants as a best feature</p> <p>Transport of the Lee Enfield (n=125, multiple answers allowed): Snowmobile (60.0%) BV 206 (4.0%) Boat (60.0%) ATV (40.0%) Civilian vehicle (65.6%) Dog sled (3.2%) Other (15.2%)</p> <p>Sling swivel of Lee Enfield noted as frequently broken</p>	<p>Revised Substantiation: The Ranger will frequently sling his/her rifle while driving a snowmobile, all terrain vehicle, or traveling, by dog-sled or hiking on foot. It is essential that the sling swivels be sufficiently robust to withstand extremely harsh handling over an extended period.</p>

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				<p>component (14 of 74)</p> <p>Durability (handling/transport) 5th of 12 performance requirements (mean=5.6, SD=1.3, n=133)</p> <p>Focus group comments emphasized durability in selection of sling swivels.</p>	
1.d.	Iron Sights	It is mandatory that the Ranger rifle be fitted with robust and protected "iron" sights. The extreme temperatures experienced during Ranger operations make optical sights impractical and subject to fogging and premature destruction.	The sights of the rifle are arguably the most vulnerable component and as such the original equipment manufacture should pay special attention to this requirement.	<p>Sights of Lee Enfield cited by 24.3% of participants as a best feature but sights (durability, lack of scope mount) cited by 23.0%</p> <p>Accuracy of Lee Enfield cited by 16.5% of participants as a best feature and 10.6% as a worst feature</p> <p>Iron sight of Lee Enfield noted as frequently broken component (26 of 74)</p> <p>Accuracy 2nd of 12 performance requirements (mean=6.0, SD=1.2, n=132)</p> <p>Durability (extreme environments) 3rd of 12 performance requirements (mean=6.0, SD=1.3, n=132)</p> <p>Durability (handling/transport) 5th of 12 performance requirements (mean=5.6, SD=1.3, n=133)</p> <p>Sights (n=116):</p> <ul style="list-style-type: none"> Iron sight only (19.9%) Iron sight with provision for optical sight (44.8%) Optical sight with back-up iron sight (19.8%) No preference (17.2%) <p>Iron Sights (n=100):</p> <ul style="list-style-type: none"> Protected, hood/guards (67.2%) Open (20.7%) No preference (12.1%) 	No revisions.

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1.e.	Extractor	The extractor must allow direct round chambering. Under emergency conditions the Ranger must be capable of loading a cartridge into the breech by "dropping" a round directly on the magazine plate and driving the bolt close. The extractor and the other parts that comprise the bolt and breech mechanism must be capable of withstanding repeated emergency loading drills.	The requirement is for a military small arm that is intended, when necessary, to be used in close combat.	<p>Direct Round Chambering (n=127):</p> <p>Allow (63.8%) Not allow (11.0%) No preference (25.2%)</p> <p>Focus group comments suggested this requirement be based on convenience, functioning without magazine, and emergency reload for predator defence, not close combat considerations.</p>	Revision to Comment: This requirement is for a self defence small arm that is intended to be used for protection from predators.
1.f.	Minimum Maintenance	The CR Rifle must require minimum maintenance to continue to operate.	The care and maintenance given to the CR Rifle will vary among individual members of the CR. What is constant is that the majority will operate under some of the most brutal operational and environmental conditions on the planet. A rifle that requires substantial maintenance to function properly will be rejected by the Rangers.	<p>Lee Enfield Cleaning Frequency (n=102):</p> <p>Daily (2.0%) Weekly (6.9%) Monthly (37.3%) Semi-annually (41.2%) Annually (12.7%)</p> <p>Lee Enfield cleaned after each use (n=127):</p> <p>Yes (76.4%) No (23.6%)</p> <p>Ease of Repair/Cleaning of Lee Enfield cited by 14.8% of participants as a best feature</p> <p>Importance of minimizing and ease of maintenance 8th of 12 performance requirements (mean=5.3, SD=1.3, n=133)</p>	Revision to Comment: The care and maintenance given to the CR Rifle will vary among individual members of the CR. What is constant is that the majority will operate under some of the most brutal operational and environmental conditions on the planet.
1.g.	Robust Stock	A rifle normally has a butt and forestock that is made of wood, metal or a synthetic product.	The stock of the Ranger's rifle must be extremely robust and built to withstand the rigours of extended life	<p>Wood Stock of Lee Enfield cited by 8.8% of participants as a worst feature</p> <p>Durability of Lee Enfield cited by 47.0% participants as a best</p>	<p>No revisions.</p> <p>Further investigation into relative durability and other characteristics of different stock</p>

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			in a harsh service environment	<p>feature</p> <p>Fore stock (14 of 74) and butt stock (8 of 74) of Lee Enfield noted as frequently broken components</p> <p>Durability (extreme environments) 3rd of 12 performance requirements (mean=6.0, SD=1.3, n=132)</p> <p>Durability (handling/transport) 5th of 12 performance requirements (mean=5.6, SD=1.3, n=133)</p> <p>Stock Material (n=133): Hardwood (25.6%) Laminated wood (4.5%) Synthetic (32.3%) Composite metal/synthetic (17.3%) No preference (20.3%)</p>	materials.
1.h.	Transportation Case (Hard Case)	<p>The Ranger resides in and operates from his/her local community. The tradition of leaving houses, automobiles and other vehicles unlocked in the North, Arctic and High Arctic continues.</p> <p>The OEM shall provide a suitable hard case that can be securely locked and when required secured to the interior of a building or residence to create a secure rifle rack.</p>	The requirement for a Hard Case would provide deterrence to theft and the inappropriate use of DND property by non CF personnel. The Hard Case will assist the CR safe-guard his/her rifle.	<p>Storage of Lee Enfield (n=130): At home (67.7%) At patrol base (11.5%) At CRPG HQ (20.0%)</p> <p>Case (n=131): Hard case (38.9%) Soft case (13.0%) Both (40.5%) No case (0.8%) No preference (6.9%)</p> <p>Lockable Case (n=69): Yes (89.9%) No (2.9%) No preference (7.2%)</p> <p>Focus group comments recommended case that is capable of being mounted to a snowmobile or ATV via slots / anchor</p>	No revisions.

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				holes in case, is water proof, and is approved for commercial airline travel.	
1.i.	Carrying Case (Soft Case)	<p>The Ranger will occasionally travel by aircraft, motor vessel or other means of transportation used in Canada including commercial airlines and buses etc. It is essential that the Ranger be provided with a durable rifle carrying case that will secure and protect DND property.</p> <p>The OEM shall provide a suitable soft carrying case equipped with a sling and a carrying handle at the point of balance.</p>		<p>See line 1.h.</p> <p>Drag Bag / Pack vice Soft Case (n=68) Drag bag / pack (45.6%) Soft storage case (22.1%) No preference (32.4%)</p> <p>Focus group comments that case must be approved for commercial airline travel.</p>	Revision to Substantiation, 2 nd paragraph: The OEM shall provide a suitable drag bag / pack equipped with shoulder straps and a carrying handle at the point of balance.
1.j.	Small arm identification	<p>The Royal Canadian Mounted Police (RCMP) and other authorities in the North, Arctic and High Arctic must be able to immediately identify a Canadian Ranger and his/her rifle by its distinctive colour and configuration given that the Ranger often travels in civilian clothes because he/she is not provided with a CF uniform.</p>	<p>The rifle must be distinctive and easily identifiable as the Canadian Ranger rifle so it is easily distinguishable at a distance. This feature would minimize its use by non Canadian Rangers and reinforce its symbolic importance to the members.</p>	<p>See line 8.</p> <p>CRR Identification (n=134, multiple answers allowed): Distinctive logo / emblems / crest (46.3%) Distinctive stock colour (12.7%) Distinctive barrel (7.5%)</p> <p>Focus group discussions suggest Canadian Ranger logo.</p>	Revision to Substantiation: The Royal Canadian Mounted Police (RCMP) and other authorities in the North, Arctic and High Arctic must be able to immediately identify a Canadian Ranger and his/her rifle by its distinctive colour and configuration given that the Ranger often travels in civilian clothes.
1.k.	Protected	Special measure will be	Failure to adopt protective	Durability of Lee Enfield cited by 47.0% participants as a best	No revisions.

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	Barrel and components	recommended to protect the barrel, rifle bore and other components of the rifle from rust and premature deterioration because of the harsh environmental conditions	measures means that the in-service life of the rifle will be reduced and NP cost to sustain the CR Rifle fleet will be higher. The second consequence is that rifle will fail to act as a "motivator" and a source of pride for Ranger.	feature Barrel of Lee Enfield noted as frequently broken component (12 of 74) Durability (extreme environments) 3 rd of 12 performance requirements (mean=6.0, SD=1.3, n=132) Barrel (n=69) Stainless steel (76.8%) Nickel (4.3%) Blued (11.6%) No preference (7.2%) See line 8.	
7	Requirements Table				
2.	Table 2 - Performance Characteristic	Mandatory	Desirable		
2.a.	The CR Rifle must be capable of achieving a probability of a hit (P Hit) when fired in a prone supported position of 0.9 against a standing STANAG 4512 ²² unprotected human target at 300 m from the first round.	X		See line 8.a.	Revision to Performance Characteristic: The CR Rifle must be capable of achieving a probability of a hit (P Hit) when fired in a prone unsupported position of 0.9 against a bull's eye target (as a surrogate target for large game, as adapted from STANAG 4512 ²³ unprotected human target) at 300 m from the first round.
2.b.	The CR Rifle must have a magazine capacity of 10, 7.62mm cartridges. ²⁴ The magazine must be detachable from the rifle.	X		Magazine (capacity, detachable) of Lee Enfield cited by 16.5% of participants as a best feature but Magazine (insertion, release) cited by 22.1%	Consider adding another line specifying number of magazines provided with each rifle (data indicates 2 per rifle is mandatory).

²² NATO AC/225-D/1365 STANAG 4512 Edition 1 Dismounted Personnel Target Original English 10 Nov 95

²³ NATO AC/225-D/1365 STANAG 4512 Edition 1 Dismounted Personnel Target Original English 10 Nov 95

²⁴ Requirement for a detachable magazine was validated at the informal meeting at Connaught Range 19 Sep 08.

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SOR Statement				Validation Exercise Evidence	Revisions / Comments
				<p>Magazine of Lee Enfield noted as frequently broken component (40 of 74)</p> <p>Rate of Fire / Speed of Engagement / Loading 7th of 12 performance requirements (mean=5.3, SD=1.4, n=133)</p> <p>Magazine Capacity (n=133): 3 rounds (0.0%) 4 rounds (2.3%) 5 rounds (16.5%) 6 rounds (4.5%) 10 rounds (59.4%) Other (9.8%) No preference (7.5%)</p> <p>Focus group comments suggested a smaller magazine capacity would be acceptable if more than one magazine was provided with each rifle or if magazines of different capacities were provided (e.g. two 10 round and one 5 round)</p> <p>Magazine System (n=127) Detachable (73.2%) Fixed/Internal (11.8%) No preference (15.0%)</p> <p>Magazine Style (n=67): Box (88.1%) Rotary drum (1.5%) No preference (10.4%)</p> <p>Magazine Material (n=68): Steel (44.1%)</p>	<p>Conduct further research into most durable material for magazine construction.</p> <p>Revision to Performance Characteristic: The CR Rifle must have a magazine capacity of 10, 7.62mm cartridges.²⁵ The magazine must be a box style magazine that is detachable from the rifle and is loaded while detached.</p>

²⁵ Requirement for a detachable magazine was validated at the informal meeting at Connaught Range 19 Sep 08.

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	SOR Statement			Validation Exercise Evidence	Revisions / Comments
				Polymer (38.2%) No preference (17.6%) Number of Magazines (n=69): 1 magazine (7.2%) 2 magazines (60.9%) 3 magazines (29.0%) No preference (2.9%) Loading of Magazine (n=69): While attached (10.1%) While detached (82.6%) No preference (7.2%)	
2.c.	The CR Rifle must be capable of firing either Full Metal Jacket CF ammunition commercial .308 cal ammunition.	X		See line 1.b.	No revisions.
2.d.	The CR Rifle must be a bolt-action, magazine-fed rifle of a proven design.	X		See line 1.a.	No revisions.
2.e.	The CR Rifle shall be fitted with rear and front iron sights. ²⁶	X		See line 1.d.	No revisions.
2.f.	It is essential that a CF weapon technician can remove and replace the front and rear sights and sight guards (protectors) should they become damaged.	X		No data.	No revisions.
2.g.	The CR Rifle should be capable of mounting an optional optical sight.		X	See line 1.d. Optical Sight Mount (n=114): NATO standard rail (37.7%) Recreational scope mount (29.8%) Other (0.9%) No preference (31.6%)	Revision: Change from desirable to mandatory. Performance Characteristic: The CR Rifle must be capable of mounting an optional optical sight.
2.h.	The CR Rifle must not weight more than a fully	X		Weight of Lee Enfield cited by 70.8% of participants as a	Revised Performance Characteristic:

²⁶ The meeting at Connaught Range on 19 Sep 08 pointed to the need to conduct a serious and detailed investigation into the type of iron sight to be provided.



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	SOR Statement			Validation Exercise Evidence	Revisions / Comments
	loaded .303 Cal Lee Enfield rifle less the bayonet.			worst feature and 11.3% as a best feature Transport / Mobility 6 th of 12 performance requirements (mean=5.4, SD=1.3, n=132) Weight (n=131): More than Lee Enfield (2.3%) Equal to Lee Enfield (17.6%) Less than Lee Enfield (67.2%) No preference (13.0%)	The CR Rifle must weigh less than the .303 Lee Enfield rifle.
2.i.	The CR Rifle should weight less than a fully loaded .303 Lee Enfield rifle.		X	See line 2.h. Weight should be less than (n=125): 7.0 lbs (19.2%) 7.5 lbs (17.6%) 8.0 lbs (21.6%) 8.5 lbs (8.8%) 9.0 lbs (13.6%) 9.5 lbs (3.2%) 10 lbs (0.8%) 10.5 lbs (1.6%) No preference (13.6%)	Revised Performance Characteristic: The CR Rifle should weigh less than 8.0 lbs.
2.j.	The CR Rifle is intended to be used by a military component of the CF and as such all components of the CR Rifle shall be completely interchangeable as described in NATO Document AC/225 Panel III D/14 Edition 1992, Para 2.23.1 to 2.23.4 inclusive. Any component that cannot be interchanged must bear the weapon serial number to avoid the incorrect use of parts.	X		No data.	No revisions.
2.k.	The CR Rifle must be designed so that there are no exposed parts that could injure the Ranger.	X		No data.	No revisions.
2.l.	The Ranger should be capable of loading five rounds in the magazine in five second.		X	Rate of Fire / Speed of Engagement / Loading 7 th of 12 performance requirements (mean=5.3, SD=1.4, n=133)	Revised Performance Characteristic: The Ranger should be capable of loading five rounds into the magazine in less than 10

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				Time to load 5 rounds in the magazine (n=110): <5 seconds (18.1%) 5-10 seconds (44.1%) 10-15 seconds (16.5%) >15 seconds (4.7%) No preference (16.5%)	seconds.
2.m.	In an emergency the Ranger must be capable of opening the bolt and inserting a cartridge into the breech and preparing the rifle to fire without the use of the magazine.	X		See line 1.e.	No revisions.
2.n.	The CR Rifle must be designed in a way that it can be effectively operated by 5% to 95 % of the male and female Ranger population.	X		Adjustability 9 th of 12 performance requirements (mean=5.2, SD=1.3, n=133) Pull Length (n=133): Adjustable (58.6%) Fixed (18.8%) No preference (22.6%) Cheek Comb (n=126): Adjustable height (25.4%) Fixed height (40.5%) No preference (34.1%) Stock Length (n=68): One fixed length (14.7%) Multiple fixed lengths (66.2%) Not required, adjustable (2.9%) No preference (16.2%) Multiple Length Stocks (n=41): Two sizes, 12" & 15" (22.0%) Three sizes, 12", 13.5", & 15" (56.1%) Other (17.1%) No preference (4.9%) Adjusting Pull Length (n=69):	No revisions to Performance Characteristic 2.n. Consider adding line regarding pull lengths and multiple fixed lengths of stocks.

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				Fixed pads (49.3%) Adjustable (31.9%) Not required (7.2%) No preference (11.6%) Butt Stock Angle (n=68): Adjustable (29.4%) Fixed (37.7%) No preference (33.3%)	
2.o.	The CR Rifle should include a device that visibly indicates when the rifle is ready to fire.		X	Cocking Indicator (n=133): Yes (82.7%) No (3.0%) No preference (14.3%)	Revision from desirable to mandatory. Revised Performance Characteristic: The CR Rifle must include a device that visibly indicates when the rifle is ready to fire.
2.p.	CR Rifle must have a distinctive colour and identifying features such as a logo, emblem or crest.	X		See line 1.j. Stock Appearance (n=133): Camouflage pattern (27.1%) Grey synthetic (9.0%) Black synthetic (19.5%) Green synthetic (9.0%) Wood (20.3%) Other (3.0%) No preference (12.0%) Focus group discussions suggest that if camouflage pattern is used it should be CADPAT Stainless steel barrel desired but not uniquely distinctive	Consider specifying in greater detail what distinctive colour and identifying features are mandatory. Suggest mandatory inclusion of Canadian Ranger logo on butt stock as identifying feature.
2.q.	CR Rifle must have a means to adjust the length of the butt stock to accommodate Rangers of different body sizes. The rifle must be equipped with a recoil-absorbing butt to reduce the recoil forces on Rangers with a small stature.	X		See line 2.n. Recoil Absorbing System (n=127): Yes (65.4%) No (13.4%) No preference (21.3%) Recoil Pads (n=69):	Consider dividing statement into two separate lines; one specifying butt stock lengths and a second specifying recoil absorbing pads for Rangers of all statures. Performance of recoil pads in extreme cold should be assessed.

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				Yes (81.2%) No (10.1%) No preference (8.7%) Embedded Recoil System (n=69): Yes (18.8%) No (42.0%) No preference (39.1%)	
2.r.	CR Rifle must have a means to adjust the height of the comb on the butt stock to accommodate Rangers of different body sizes and the fact that over the course of the year the clothing worn by the Ranger will vary greatly.	X		Adjustability 9 th of 12 performance requirements (mean=5.2, SD=1.3, n=133) Cheek Comb (n=126): Adjustable height (25.4%) Fixed height (40.5%) No preference (34.1%) Focus group discussion indicated adjustable cheek comb not desirable due to added complexity Butt Stock Cheek Shape (n=102): Classical style, straight (35.3%) Monte Carlo style, raised (48.0%) Thumb-hole style (3.9%) Other (1.0%) No preference (11.8%)	Statement not supported by data, should be deleted. Consider size and fit implications of a statement regarding Monte Carlo style butt stock cheek shape.
2.s.	The rifle must be capable of attaching a adjustable bipod. The bipod will allow the Ranger to support the rifle during surveillance tasks.	X		Modularity / Configurability / Interchangeability 12 th of 12 performance requirements (mean=4.8, SD=1.8, n=133) Bipod (n=69): Yes (30.4%) No (59.4%) No preference (10.1%) Focus group discussions indicated a forward under-mount may be desirable for attaching accessories (e.g. bipod, light)	Revision from mandatory to desirable. Revised Performance Characteristic: The rifle should be capable of attaching accessories to the fore stock using a NATO standard rail system.
2.t.	The trigger guard musts accommodate a glove	X		Compatibility 11 th of 12 performance requirements	Statement not well supported and does not

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	hand.			(mean=5.0, SD=1.5, n=132) Trigger Guard (n=70): Fixed (68.6%) Removable for compatibility with gloves (24.3%) No trigger guard (0.0%) No preference (7.1%)	define glove to accommodate. Consider revision to desirable and specification of glove type.
2.u.	The rifle must be equipped with a manual safety that can be operated with a gloved hand.	X		Compatibility 11 th of 12 performance requirements (mean=5.0, SD=1.5, n=132) Safety Operable With Gloves (n=69): Yes (78.3%) No (5.8%) No preference (15.9%)	No revisions.
2.t.	The rifle will be provided with a sub calibre training device that is capable of firing a .22 calibre Long Rifle cartridge.	X		No data	No comment.
2.u	The rifle must be provided with as two-stage trigger configuration similar to the one now used on the Lee Enfield.	X		Trigger Stages (n=70): Single stage (25.7%) Double stage, short take-up and target pull (68.6%) No preference (5.7%) Trigger Stroke (n=70): Short stroke (54.3%) Long stroke (24.3%) No preference (21.4%) Trigger Pull Force (n=70): Adjustable (60.0%) Set (30.0%) No preference (10.0%)	Revised Performance Characteristic: The CR Rifle must be provided with a two-stage, short stroke trigger with the trigger pull force capable of user adjustment.
3.	Protection	Mandatory	Desirable		
3.a.	The CR Rifle front and rear sight must be protected from accidental damage.	X		See line 1.d.	No revisions.
3.b.	The CR Rifle must be provided with robust butt	X		See line 1.g.	No revisions.

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	and fore stock that is highly resident to accidental and environmental damage.				
3.c.	The sling swivels on the CR Rifle must be extremely robust and capable of withstanding harsh wear and tear over a prolonged period.	X		See line 1.c.	No revisions.
3.d.	The CR Rifle hard carrying case must be securable, waterproof to a depth of one metre. The CR Rifle hard carrying case must accommodate the rifle, six 10 round magazines, cleaning kit/tools and the optional sight.	X		See line 1.h. Number of Magazines (n=69): 1 magazine (7.2%) 2 magazines (60.9%) 3 magazines (29.0%) No preference (2.9%)	Revised Performance Characteristic: The CR Rifle hard carrying case must be securable, waterproof to a depth of one metre. The CR Rifle hard carrying case must accommodate the rifle, two 10 round magazines, cleaning kit/tools, and the optional sight.
3.e	The rifle should be provided with a suitable hard case that contains the Canadian Ranger insignia and constructed in a distinctive colour scheme.		X	No direct data. See line 1.j.	No revisions.
3.f.	It is essential that the CR Rifle be provide a suitable soft case that can be locked, when required.			See line 1.i.	No revisions.
3.g	The CR Rifle shall be capable of surviving and operating in the climatic regions described by A1, A2, A3, B1, B2, B3 C0, C1, C2, C3 of STANAG 2895.	X		STANAG 2895 not available for review. Durability of Lee Enfield cited by 47.0%participants as a best feature Reliability of Lee Enfield cited by 36.5% of participants as a best feature and 13.3% as a worst feature Reliability 1 st of 12 performance requirements (mean=6.2, SD=1.2, n=133) Durability (extreme environments) 3 rd of 12 performance requirements (mean=6.0, SD=1.3, n=132)	No comment.
3.h	The CR Rifle shall be capable of being transported (as loose and secured cargo) using SMP vehicles and other vehicles typically used by the Canadian Rangers including skidoos,	X		See lines 1.c. and 1.h.	Revised Performance Characteristic: The CR Rifle shall be capable of being transported (as loose and secured cargo) using SMP vehicles and other vehicles

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	SOR Statement			Validation Exercise Evidence	Revisions / Comments
	trailers and sleds.				typically used by the Canadian Rangers including snowmobiles, trailers and sleds.
3.i	The rifle stock must be made of the appropriate synthetic material.	X		See line 1.g.	Contradiction with line 1.g.
3.j	The Ranger rifle will be provided with a combat knife.	X		CR are not intended to fill a combat role. Hunting Knife (n=131): Yes (85.5%) No (4.6%) No preference (9.9%) See line 8.	Revised Performance Characteristic: The CR Rifle will be provided with a hunting knife.
4.	<i>User Acceptance</i>	<i>Mandatory</i>	<i>Desirable</i>		
4.a.	Comparative Testing. Comparative testing of candidate rifle will be a key component in the selection of the CR Rifle. It is anticipated that the following test activities will be undertaken.	X		No data.	No comment.
4.b.	Range Testing. Live fire testing on a range will be conducted to determine the performance characteristics of the candidate rifle. Live fire testing will take place under a variety of climatic conditions.	X		No data.	No comment.
4.c.	User Trials. Candidate CR Rifles will subject to tactical handling and compatibility trials to ensure that the rifle is capable of meeting the Ranger's requirements in a tactical setting.	X		No data.	No comment.
4.d.	The CR Rifle will be provided with the ancillary items listed under the heading Deliverables below.	X		No data.	No comment.
4.e.	The CR Rifle shall be equipped with a cleaning kit.	X		Cleaning Kit (n=131): Internal storage compartment for cleaning supplies (23.7%) Separate cleaning kit (33.6%) Storage compartment and separate kit (25.2%) No preference (17.6%)	Consider defining the specific items to be contained in the cleaning kit.

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	<u>SOR Statement</u>			<u>Validation Exercise Evidence</u>	<u>Revisions / Comments</u>
				Cleaning Kit Contents (n=70, multiple answers allowed): Pull Through (70.1%) Flexible Push Rods, memory (61.2%) Bore Brushes (59.7%) Rod Handle T (55.2%) Gun Oil (55.2%) Breech Brush (53.7%) Brass slotted tips (52.2%) Steel Push Rods (47.8%) Obstruction Remover (43.3%) Brass Push Rods (41.8%)	
4.f.	The CR Rifle cleaning kit must be as compact as possible	X		See line 4.e.	Not enforceable as written, consider specifying desirable dimensions.
4.g.	The CR Rifle must be provided with a robust adjustable sling.	X		Transport of the Lee Enfield (n=125, multiple answers allowed): Snowmobile (60.0%) BV 206 (4.0%) Boat (60.0%) ATV (40.0%) Civilian vehicle (65.6%) Dog sled (3.2%) Other (15.2%) The Lee Enfield sling noted as a frequently broken component (4 of 74) Durability (handling/transport) 5 th of 12 performance requirements (mean=5.6, SD=1.3, n=133) Transport / Mobility 6 th of 12 performance requirements (mean=5.4, SD=1.3, n=132) Sling (n=131): Yes (85.5%) No (4.6%)	Revised Statement: The CR Rifle must be provided with a robust adjustable two point sling. Consider adding additional desirable statement: The CR Rifle sling should include a section of padding with a non-slip material.



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	SOR Statement			Validation Exercise Evidence	Revisions / Comments
				<p>No preference (9.9%)</p> <p>Sling Type (n=69): Single point (5.8%) Two point (75.4%) Three point (13.0%) No preference (5.8%)</p> <p>Sling Pattern (n=69): Similar to Lee Enfield, military pattern (40.6%) Padded (55.1%) No preference (4.3%)</p> <p>Non-Slip Material Sling (n=69): Yes (66.7%) No (11.6%) No preference (21.7%)</p> <p>Sling Material (n=69): Leather (29.0%) Nylon (34.8%) Neoprene (11.6%) No preference (24.6%)</p>	
5.	Security and Safety	Mandatory	Desirable		
5.a.	The CR Rifle must include a manual-operated safety device that will prevent the rifle from being fired.	X		<p>Safety System (n=70): 3 position (31.4%) 2 position (58.6%) No preference (10.0%)</p> <p>Safety Style (n=70): Tang style (21.4%) Cross bolt style (21.4%) Wing style (18.6%) No preference (38.6%)</p> <p>If 3 Position Wing Style (n=40):</p>	Consider further elaboration of safety design requirements.

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	<u>SOR Statement</u>			<u>Validation Exercise Evidence</u>	<u>Revisions / Comments</u>
				Horizontal wing (15.0%) Vertical wing (27.5%) No preference (45.0%) Not applicable (12.5%) Safety Location (n=69): Right side (26.1%) Left side (17.4%) On top (37.7%) No preference (18.8%) Cocking Indicator (n=133): Yes (82.7%) No (3.0%) No preference (14.3%) See line 2.u.	
5.b	It must be possible to lock the hard case. Locks and keys must be provided.	X		See line 1.h. Storage Trigger Lock (n=69): Yes (88.4%) No (7.2%) No preference (4.3%) Built-in Trigger Lock (n=29): Yes (79.3%) No (6.9%) No preference (13.8%)	Consider elaboration to include trigger lock.
6.	<i>Sustainability</i>	<i>Mandatory</i>	<i>Desirable</i>		
6.a.	The CR Rifle is a military small arm and as such is similar to the C7A2 assault rifle in terms of fit, form and function. It shall be treated like the other SARP small arms in terms of in-service support. That is the CR Rifle shall have the capability of guaranteed sustainability throughout its in-service life. This capability includes the	X		No data.	No comment.



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	SOR Statement			Validation Exercise Evidence	Revisions / Comments
	production of all small arms parts and complete weapons, overhaul and maintenance of the rifle, life cycle material management of the rifle, and production of ammunition for the rifle. Guaranteed sustainability is only possible within the Canadian Defence Industrial Base. Therefore, it is essential that production of the CR Rifle and its ammunition, its overhaul and maintenance and its life cycle material management be done in Canada.				

Note: More SOR statements could be derived from the Human Factors Requirements Validation data set; however the analysis contained in this annex has been limited to the current draft SOR statements.

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(U) The Directorate of Land Requirements (DLR) is engaged in an acquisition process that will deliver a new Canadian Ranger Rifle (CRR) capability to the Canadian Forces (CF). The aim of this project was to assist the DLR in assessing the draft operational requirements and better define the overall CF requirement for a new CRR. Eight half-day workshops were held with 135 Canadian Ranger (CR) personnel from four of the five Canadian Ranger Patrol Groups (CRPG). The workshops were broken down into five modules: background information, weapon use inventory, performance requirements, basic technical requirements, and detailed technical requirements. The in-service Lee Enfield No 4 Mark 1* rifle is generally considered a durable, reliable, and accurate weapon but is faulted for its weight, age and availability of parts, and magazine. Protection from predators, hunting/survival tool, and a symbol of Canadian sovereignty/CR were the most important roles of the CRR. Reliability, accuracy, and durability in extreme environments were most important performance criteria. The basic and detailed technical requirements modules collected CR preferences on specific characteristics and features wanted in the new CRR. Results suggest the new CRR should be a bolt action of .308 Winchester / 7.62mm calibre that is shorter and weighs less than the current Lee Enfield. Further technical requirements are presented and discussed. Overall, the results from these workshops indicate that the CR require a reliable, durable, and accurate rifle, with updated features that is lighter than the current Lee Enfield.

(U) La Direction – Besoins en Ressources Terrestres (DBRT) est engagée dans un processus d'acquisition qui livrera une capacité de nouveau Fusil de Rangers Canadiens (FRC) aux Forces Canadiennes (FC). Le but de ce projet était d'assister la DBRT dans l'évaluation d'une ébauche de besoins opérationnels et de mieux définir les besoins globaux qu'on les FC envers un nouveau FRC. Huit ateliers d'une demi-journée ont eu lieu avec 135 Rangers Canadiens (RC) provenant de quatre des cinq Groupes de Patrouilles des Rangers Canadiens (GPRC). Les ateliers furent divisés en cinq modules : informations générales, inventaire de l'utilisation d'armes, les critères de performances, les exigences techniques de base et exigences techniques détaillés. Le fusil Lee Enfield No 4 Mark 1* actuellement en service est généralement considéré comme une arme durable, fiable et précise mais est prise en défaut pour son poids, son âge et la disponibilité des pièces et de son chargeur. La protection contre les prédateurs, outil de survie/de chasse et un symbole de la souveraineté/RC étaient les rôles les plus important du FRC. La fiabilité, précision et la durabilité dans des environnements extrêmes furent les critères de performance les plus important. Les modules d'exigences techniques de base et détaillées ont collectés les préférences des RC sur des caractéristiques et fonctions désirées sur un nouveau FRC. Les résultats suggèrent que le nouveau FRC devrait être une Winchester .308 à verrou de calibre 7.62mm plus courte et plus légère que la Lee Enfield actuel. D'autres exigences techniques sont présentés et discutés dans ce document. Dans l'ensemble, les résultats de ces ateliers indiquent que les RC exige un fusil fiable, durable et précis avec des fonctionnalités mises à jour tout en étant plus léger que la Lee Enfield actuel.

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(U) Lee Enfield No 4 Mark 1, artic predators, extreme environment

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